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A study on the impact of teacher attitude/efficacy on the use of classroom technology

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A STUDY ON THE IMPACT OF TEACHER ATTITUDE/EFFICACY ON THE USE OF CLASSROOM TECHNOLOGY

A dissertation submitted in partial satisfaction

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by

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This dissertation, written by

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DOCTOR OF EDUCATION

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DEDICATION

I dedicate this dissertation work to all of my family who supported me throughout the years of this journey. A special feeling of gratitude to my wife, Elizabeth Ott, whose support over the many years never wavered. The times I was away from home were never easy, especially when our daughter, Colette, was only two years old. I will forever appreciate you for allowing me to experience learning at Pepperdine University. Thank you, Liz, for the constant encouragement and for guiding me through three variations of my dissertation topic, only to end up exactly where you knew I would be all the time.

I also dedicate this dissertation to my parents, Roger and Loris Mitchell, who have supported me throughout this process. Mom, I will always appreciate you for the encouragement and support needed to attend Pepperdine's Education Technology program. From the first day I learned about the program, you had my back. Without you, I would not have had the courage to apply to the program, and to pursue such an awesome adventure that has led me to so many new opportunities. I will also always appreciate you for the hours of proof reading and editing you have endured over the past five years.

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VITA

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ABSTRACT

Increased access to technology has changed the current educational landscape and, will dramatically affect the future of education. These shifts are redefining the roles of educators and require that teachers have the attributes necessary to legitimately incorporate technology into the classroom.

The purpose of this study is to examine existing characteristics of teachers employed at Minarets High, which uses a 1-to-1 and project-based curriculum, to determine if there are any relationships between the selected measures.

The research questions are:

1) What teacher and district/school factors allow for effective technology integration? Specifically,
    a. What relationship, if any, exists between teachers' sense of self-efficacy and teachers' attitudes toward instructional technology?
    b. What relationship, if any, exists among the factors of teachers' sense of self-efficacy (Student Engagement, Instructional Practice and Classroom Management) and Student Productivity?
    c. What district/school factors, if any, promotes the use of technology in the classroom by and for students?

Based on the literature review on the topic of teacher self-efficacy and attitudes toward technology, research was conducted using questionnaires to quantify the existence and extent of any relationships between teachers' self-efficacy and attitudes, follow-up interviews were used to identify various school and district factors that promote the use of technology in the classroom.

The data were analyzed using descriptive statistics, Pearson-r correlations, and through the coding of interviews. There were 16 surveys and 9 interviews. The study did reveal the high self-efficacy and positive attitude that teachers have towards technology. Through interviews, attributes were identified and the *Technology Integration Framework at Minarets* was developed to visualize the creation of an *atmosphere* of learning at Minarets.

The outcome of this research suggests that the integration of technology into the modern-day classroom goes much deeper than merely purchasing hardware for the teachers and students to use. The findings show that beyond access there are many other factors that affect the student learning experience. The study revealed an intricate system of *Student Experience Influencers* that is required for Minarets to provide this unique learning space.

Chapter One: Introduction, Problem, and Purpose

Introduction

Over the last decade, Chawanakee Unified School District has been able to provide a unique high school experience for students of the Central Valley and Sierra Foothills. Chawanakee Unified has the only comprehensive high school in the State of California with seamless integration of both public and charter students on the same campus (CDE, 2016). Minarets High School and Minarets Charter High School occupy the same physical and digital space while providing all students with access to the same teachers and resources across all disciplines. The name Minarets is used by the students and community to identify the combined schools as a single unit. Chawanakee Unified is also able to provide this unique combination on a large rural campus that uses project-based learning and was designed to focus on the use of 1-to-1 technology.

Within the first five years, Minarets has been recognized as a 2011 Golden Bell School, 2011 and 2012 Apple Distinguished School, and is fully WASC (Western Association of Schools and Colleges) accredited. Minarets also employs many distinguished staff, such as the 2012 CUE California Administrator of the Year, 2010 and 2012 CUE Teachers of the Year, Apple Distinguished Educators and Google Certified Innovators. In 2016 Minarets 11th graders took the computer-based California Assessment of Student Performance and Progress (CAASPP) assessment, and they scored the highest in Madera County. In Mathematics, 78% of students nearly met, met or exceeded standards (compared to 71% for the state). In English Language Arts 88% met or exceeded standards (compared to 42% for the state). Minarets students have

also achieved multiple academic, arts and sports awards over the past decade including being the 2012 FFA Parliamentary Procedure National Champions.

Minarets offers a variety of dual enrollment college courses allowing students to complete between 15-18 units of college credit. Now in their ninth year, Minarets students have been accepted into every California State University, University of California as well as other top universities. In the coming years, the expanded offering of college level coursework will even better prepare graduates for furthering their education in local, state and national colleges.

These are just some of the factors that can be attributed to identifying Minarets High School as a school of excellence. Minarets was designed to implement 1-to-1 technology with a project-based emphasis since its inception, and as such has developed a unique culture fostering the use of technology to meet educational goals around the 6 C's of 21st Century Learning: Critical Thinking, Competency, Creativity, Collaboration, Communications and Community (Chawanakee, 2016). Minarets High School can be a model for other well-established schools as they look to integrate project-based learning (PBL) and 1-to-1 technology in the future. The culture, attitudes, and belief in the value of technology provide an insight to the requirements of fully implementing technology and project-based learning in a public school. Minarets was intentionally designed to meet the needs of the modern-day students, and the same design can be applied to schools that have existed for years. This study seeks to provide insight on a few key factors that could assist any school in the integration of education technology.

District Background

Chawanakee Unified School District is located in Eastern Madera County with its district office in North Fork, California, 20 miles south of Yosemite National Park. The district serves slightly more than 1,200 students from TK-12th grade. For many years, the district had only two K-8 elementary schools and an extended adult and home school program. After many years of discussion, in 2003 the Board of Education decided that there was a need to build a high school within the district that would educate their students through grade 12. The school board started to go through the legal process to gain the right to teach their K-8 graduates in a district-owned high school. This process required Chawanakee Unified to legally claim their students inside predefined elementary school boundaries and to provide grade 9-12 services for all of their students who at that time attended school at two other local school districts (CDE, 9/13). When approved, the required educational services could not be immediately provided to the 9-12th-grade students, since there were no existing high school facilities. Once the paperwork was completed with the California Department of Education and other agencies, the district was then required to provide busing services to these other high schools so that their students could receive an education (CDE, 9/13). Yosemite High School and Sierra High School are both over 20 miles away from town in opposite directions along mountain roads, making this a costly effort for Chawanakee Unified. The district needed to quickly reduce this fiscal strain, so they immediately started on the process to design and fund the new high school. With a bond measure passed in 2005, the purchase of land and construction of Minarets High School began. The new Minarets High School opened for the 2008-09 school year (Sierra Star, 2008).

With the great expense involved in the building and running of a high school, the Board of Education needed to ensure that there was a reliable student population growth plan for the high school. Attendance by their existing K-8 students and the possibility of being a School of Choice for some parents outside the district were not enough to ensure that the school would remain fiscally viable. The School Board wanted additional reasons for students and parents to dedicate the time and resources needed to attend Minarets High School, so they explored their options. Ultimately, a decision was made to use technology to draw high-quality students to the school. In this digital age, there are few schools, at least in California's Central Valley, designed to incorporate technology, and even fewer designed around the technology. The School Board decided that the philosophy of teaching at Minarets High School would be to fully incorporate technology into the curriculum by placing it in the students' hands, and by providing a project-based learning environment that would leverage the ever-expanding Internet and online resources (Sierra Star, 2009; Boss & Krauss, 2007). Students would use the Internet regularly and would be creating multi-media projects to demonstrate their knowledge growth while developing skills to enhance career potential. The technology focus at Minarets would ensure that students were knowledgeable in the use of both hardware and software, so the next question was what technology would be used. With a high level of socio-economically disadvantaged students, it was decided that the technology that students used would need to be purchased by the district and loaned to each student.

Minarets High School was intended not only to provide a high school for the district's students to complete their secondary school studies, but was also intentionally

designed to attract many students from outside the district boundaries. In the era of No Child Left Behind (NCLB), opening a new high school offered an opportunity to do this by providing a non-sanctioned school for parents/students to select. The School of Choice provision implemented by NCLB allows parents the discretion to move their student(s) to a non-PI status school. Being built at a time when many of the mountain and valley schools in the area were entering Program Improvement (PI) status (the California Department of Education's official labeling of low-performing schools), Minarets was able to become a School of Choice for many students (CDE, 8/13; ED.gov, 2013). In 2009 and 2010 the expiration of NCLB caused some local districts in PI status to no longer allow parents to utilize the School of Choice provision (since the law was no longer in place) and were preventing students from transferring to Minarets High School. In response, Chawanakee Unified opened Minarets Charter High School in 2011, which is conveniently located on the Minarets High School campus. The charter high schools provision as a school of choice was unaffected by the expiration of NCLB and again allowed the district to accept any student who wished to attend Minarets through application to their charter program. As a result of creating the charter school, students living both inside and outside of Madera County now attend Minarets of their own accord and account for over half of the student population at Minarets.

District Technology Background

With the completion of Minarets High School quickly approaching, the decision of how to incorporate technology into the classroom had arrived. The first 24 students to attend high school in Chawanakee Unified School District attended class at Spring Valley Elementary (just a few miles down the road) for the 2007-08 school year, while

the Minarets campus was being completed. With the focus on media production and digital literacy, these students were each loaned an Apple MacBook that was for their use 24/7, both inside and outside of class. In August 2008, the Minarets High School campus opened with freshman and sophomore classes. Each year additional grades were added as the school expanded its services through the twelfth grade. The class of 2012 was the first to graduate from Minarets, and over the past four school years, the high school has grown to over 500 students, with each student being assigned an Apple MacBook to use during the school year.

In 2014 the potential for technology to have a significant influence on students at Minarets was also expanded by the construction of a $4-million Agricultural Technology Building. This 12,500 square-foot building incorporates cutting-edge technology, such as 3D printers for the rapid prototyping class along with a complete wood fabrication shop, auto shop and welding shop with a plasma cutter. The proposed expansion of the district Internet connection to five times the current capacity will also enable students and educators to do more with the technology that is in so many students' hands. This increase in Internet access will be an important upgrade with all students receiving an Apple MacBook Air for the 2016-17 school year. This new equipment will allow students to work with professional programs that will prepare all students for a variety of career options.

Despite all of the positives, there remains a major issue with maintaining the culture of the school as the school continues to grow. This growth has required additional staff along with the turnover every district encounters. Staffing a high school with well-qualified teachers and leaders is a challenge and is especially difficult at

Minarets with its rural location and demand for teachers who can teach in a project-based and 1-to-1 technology environment. In identifying new hires, Chawanakee Unified needs only to look at its current success to find ways to identify the best educators with the mindset of "Go Big, Go Pro, and Go Now" (Ching, 2017, p. 1).

Statement of the Problem

The authors of *Redefining Schools as Learning Organizations* state "...the technology of the computer has changed the landscape of education: redefining teachers' roles and responsibilities, expanding students' learning and communication spaces, and providing new educational and social opportunities" (Stefl-Mabry, Doane, Radlick & Theroux, 2007, p. 299). To fill newly refined teaching roles that prepare students in this expanded learning/communication space, school districts will be looking to enhance teachers' skill sets and knowledge to integrate technology into the classroom and into the general school setting (Lipper & Sagehorn, 2007). John Black and Fenwick English state "the only lasting mark any administrator makes on a school or a school system is the quality of staff he or she hires, promotes or demotes, shifts or fires" (Black & English, 1986, p. 171), and this is because educators make the learning happen, not tools, technology, or curriculum. Employing the right people for this era of technology-enhanced education is critical and will require hiring new pre-service teachers that already have the necessary skills required, along with the need to provide professional development to build these skills within current in-service teachers.

The problem under consideration is this: how do we determine if teachers have all the resources necessary to legitimately incorporate technology into the classroom? What inherent characteristics should teachers have that will enable them to utilize

various technologies (what technology a district or school chooses to purchase varies greatly) and be able to integrate that technology meaningfully into their classrooms? As witnessed by the researcher, there are teachers all along the spectrum on their personal ability to use technology and their ability to lead students in learning to use that technology. Can traits be measured that will help identify where teachers lie on this spectrum so that they can be appropriately supported with training and coaching?

This case study uses Minarets High School, a recognized district of excellence that has deployed 1-to-1 technology since inception, as a window into some possible characteristics that all, or hopefully at least many, districts can explore when laying out the foundation for implementation of new classroom technology. This school serves as an example that other district leaders can look to when designing new programs that fully integrate the use of technology and project-based learning. If there are certain common traits among this group of teachers at Minarets, then it may be possible to identify areas of growth that districts and teacher preparation programs can use to better prepare their teachers for the classroom of tomorrow.

Purpose of Study

Research on the relationship between teacher's self-efficacy and their attitude toward instructional technology has been limited. The purpose of this study is to examine several existing characteristics of teachers employed in a district that has been rich with technology for many years, and to determine if there are any relationships between the selected measures. This study proposes a two-stage approach that will examine teachers' attitude towards instructional technology using pre-existing assessment tools (Shattuck, Corbell, Osbourne, Knezek, Christensen & Grable, 2011)

and will be further supported with interviews using the concurrent-triangulation method. Schools all over the country have been purchasing classroom technology, and their districts will need teachers whose personal involvement with technology will be critical to his or her success in implementing technology in the classroom.

Teaching is no longer just about one's subject matter expertise, but also about how a teacher can effectively engage the students in their subject matter and move them up the Activity Learning Ladder to become fully active learners (Harmin & Toth, 2006). There are many ways to do this, but classroom technology is one tool that has been found to be engaging for the current generations and has been embraced by educational leaders from all over the United States. This study seeks to identify what relationship(s), if any, exist between teachers' characteristics of attitude toward instructional technology and their self-efficacy in existing 1-to-1 classrooms. If any significant and practical correlations can be identified, then districts could have another set of predictor resources to identify teachers who are likely to implement effective technology-based strategies in the classroom. This study seeks to connect teachers' self-efficacy and their attitude toward education technology as foundational skill sets for educators in the 21st-century classroom and utilizes the staff at Minarets, a forward-thinking and successful school that utilizes a project-based and 1-to-1 computer enriched learning environment located in Central California.

Research Questions

The research questions are:

1) What teacher and district/school factors allow for effective technology integration? Specifically,

a. What relationship, if any, exists between teachers' sense of self-efficacy and teachers' attitudes toward instructional technology?
b. What relationship, if any, exists among the factors of teachers' sense of self-efficacy (Student Engagement, Instructional Practice, and Classroom Management) and Student Productivity?
c. What district/school factors, if any, promotes the use of technology in the classroom by and for students?

Significance of Study

This study examines a set of teacher characteristics that relate to the success of the 1-to-1 and project-based learning program at Minarets. The significance of this study relates to the expense that districts have made in purchasing hardware, the effects on student performance due to the changed learning environment and the time saved by selecting teachers who have already developed the skills to effectively implement classroom technology.

Expenses. The choice for school districts to follow in Chawanakee Unified footsteps and to adopt technology for any classroom is an important and expensive venture. These decisions are even more important and costly when expanded throughout grade levels, schools or when implemented in an entire district (Caspary, Kusserow, Lavin & Movassaghi, 1999). In 2013 spending on K-12 classroom hardware reached $13 billion worldwide and is expected to reach $19 billion within five years (Nagel, 2014). With the huge cost of classroom technologies, there is the expectation that learning will become more efficient and growth will be exponential.

Time. If districts can employ teachers who are prepared for the new wave of technology integration, and excited to use this technology in the classroom, then districts will be able to use their professional development time to extend these teacher skill sets, not build them up from scratch. Teachers who are already well prepared and motivated to use technology will save time in implementing technology systems and will quickly have students using these new tools. The result, students will be able to increase their learning and expose themselves to the world of knowledge available to them, allowing each student to learn independently as well as collectively as a class.

Student performance. The gains of incorporating technology into a classroom can be vast if implemented by an effective teacher (Goodwyn, 2012; Schwartz, 2013), and these potential gains can be minimal if done without proper planning and prepared teachers and administrators (Hooper & Rieber, 1995). Educators must be prepared to lead students through the use of technology, and school districts need to have the tools necessary to select or train the best teachers for the positions. No longer are teaching credentials and good references enough; teachers must arrive on-site with multiple skill sets and the belief that technology will take their classroom to an enhanced level of success. If a teacher does not believe (Davis, 2009) in the positive effects that the technology will have, then there may be none. Conversely, if the teacher is prepared, has the technological knowledge and a solid pedagogy that includes technology and a firm grasp of the content, then presumably they will be able to see the positive effect that technology has on the classroom. With an effective teacher, the limited time in the classroom will be more productive, and teachers will have the time to expand their knowledge and further advance the learning in their classrooms.

The results of this study will help identify those positive characteristics that will allow Chawanakee Unified to further refine its program as the district expands into newly developing areas and to share that information with other districts that are expanding the use and adoption of technology in the classroom. Positive correlations could also help Chawanakee USD, and other districts, refine their selection of professional development offerings for new and existing teachers as their classrooms are transformed from a traditional pencil and paper based classroom to a digital one. With teachers on the front line of these implementations, knowledge about their beliefs, attitudes and technology skills will provide a valuable resource to other districts that are choosing to modernize their instructional strategies.

Assumptions

This study assumes that teachers will fill out the survey instrument and participate in interviews in such a way that it reflects their true feelings and experiences. In support of this, the data collection instrument will inform the participant that no individual responses will be shared and that any personally identifying information will not be included in the publication of this study.

Limitations

First, this study is limited to Chawanakee Unified School District, a small district with just over 1200 students and 50 educators. For enough data to be collected, all educators at Minarets High School will be asked to participate instead of a representative sample. It is thus a descriptive study of one school district. Results may vary depending on who and how many educators respond. Responses are expected to be high due to administrative support, but there is also the potential for low participation.

Some participants may respond to socially acceptable selections instead of personalized responses. The survey instruments used in this study use multiple questions and reverse scales to help eliminate this issue. Additionally, the results may not be generalized to other districts.

About the Researcher

The researcher, Jeran Ott, has previously been an employee of Chawanakee Unified School District from 2010 – 2014 as a middle school mathematics teacher at the district's two elementary schools. The researcher's world view is that of a constructive pragmatist (Creswell, 2009) believing that knowledge is constructed thought experiences and the practical application of said knowledge. Based on experiences working in the district, the researcher assumes that Minarets High School is a unique rural school that has a special combination of factors from Jon Corippo & Mike Niehoff (the original designers of the school) and high-level community support. These factors have made Minarets a next generation high school focused on the use of technology to advance students' future careers.

The researcher proposes to eliminate bias through bracketing (Chan, Fung & Chein, 2013) through the use of four steps. The first step is to prepare mentally to put aside existing knowledge about Minarets High School and its staff. The second step is to complete a research of the literature about the research questions to gain a better understanding of the questions. The third step is to plan for data collection, including face-to-face interviews using a semi-structured process guided by open-ended questions that are focused, but not leading questions. The fourth step is to code and conduct the data analysis of interviews.

Organization of the Remainder of the Study

This study is organized into five chapters. Chapter 2 reviews the current literature that is relevant to this study. Chapter 3 describes the methodology used in this study, the instruments for this study, the process for the collection of data, the analysis of collected data, and reporting process. Chapter 4 describes the data analysis procedures and the findings addressing each research question. Chapter 5 concludes the study with a full review of the problem and purpose of the study and a discussion of the conclusions, along with recommendations for future research.

Chapter Two: Review of Literature

Introduction

This study was designed to look at a school that has adopted and used technology in the classroom extensively for many years, and to identify any combination of factors from the teachers that support the implementation of various technologies in the classroom. Specifically, this study looks at factors of teachers' self-efficacy and their attitudes towards instructional technology along with select demographic data including years of teaching experience in a 1-to-1 setting.

A literature review was completed to understand each of these areas. This chapter reviews existing research in the adoption of technology into the 21st-century classroom, the fields of self-efficacy, attitudes and mindset, and current assessment tools and analysis methods to measure variables related to these subjects.

Adoption of Technology into the 21st Century Classroom

Technology has been utilized by educators since the invention of paper and the pencil. When American schoolhouses were first built, no one would have imaged where we are today and how much technology has drastically changed our society. Technology has vastly improved, especially since the 1970s, but schools have been challenged to place these tools in the classroom. Even if the technology was available at the school, teachers have not been able to impact education to the same level as businesses have been affected by the same technological advancements. This chapter looks at how education technology has evolved and why it has not yet impacted the classrooms as everyone had hoped.

Three eras of education. Modern American schooling has been in a constant state of change that is reflective of the modern day work force of the time. When looking at the history of school models, you will find that the educational system has gone through three significant eras. These eras of schooling represent the current needs of the work force and were likely revolutionary changes. The three eras of school models are: The Apprenticeship Model, Industrial Model and the Knowledge or Information Model.

The Apprenticeship Model perfectly reflects how students have learned for centuries, with the student learning by doing while being led by a master craftsman. Students worked side-by-side for extended amounts of time in learning the skills of whatever trade interested them. The apprentice would choose their trade early knowing that they would spend years learning each and every step until they were masters themselves. This is how many family traditions were passed down, from father to son and mother to daughter. The path that many followed was the path of their ancestors with minimal opportunity to gain mastery in other areas. The apprenticeship model worked well for a very long time until the Industrial Revolution changed everything.

The Industrial Model was a huge shift from one-on-one learning with the transmission of skills set from master to student, to a public-school system designed to educate every student regardless of background and experience. New expectations for student learning were developed along with the curriculum for each grade level as well as requirements to pass each grade. The industrial revolution created schools that looked for uniformity in students, similar to the outcomes of factory work (units of identical items day after day, year after year). The classrooms were didactic and

teacher controlled where everyone learned the concrete skills that were demanded in order to be part of the new workforce. The Industrial Model was a major shift from the one-on-one learning of the Apprenticeship Model, and would need to change again to address the needs of the Information Age.

The Knowledge/Information Model has developed in the last decade with the accessibility of information from the Internet using mobile devices. The dramatic growth in the technology sector has created an environment that provides anytime access for students to pursue they own goals and interests. No longer are the didactic methods of teacher-led instruction fulfilling the needs of students. Recognizing the past failing of one curriculum fits all, this new model of education looks to customize the learning for each student so that they can participate at their level and make improvements every day. Students want to interact with their world and have control over how they learn. This has created a demand for teachers to shift modes from a teacher-centered focus to a student-centered focus and in doing, so they are working to address the individual learning needs of all students. No longer is the concrete method of a standardized curriculum sufficient for students; they need a more abstract and flowing model of learning in the Information Age.

The differences in these three eras of education models go beyond the mere look and feel. Collins and Halverson (2009) identified eight factors that show the relationships between each era.

- Factor 1, the *Responsibility* of learning has shifted from Parents → State → Individuals and Parents. The Responsibility factor reflects the changes that have

occurred in the work force from master craftsmen, to industrial workers, to designers and programmers.

- Factor 2, the *Expectations* or expected outcome of learning has shifted from Social Reproduction → Success for All → Individual Choice. The Expectations factor shows how we once followed in our parents' footsteps, were then preparing for all of the industrial jobs, and now have the freedom of choice (or not knowing what careers will exist in the near future).
- Factor 3, the *Content* has shifted from Practical Skills → Disciplinary Knowledge → Learning How to Learn. The Content factor predictably reflects transferring from mastery of skills, to a more general level of knowledge, to the ability to seek out the required knowledge.
- Factor 4, the *Pedagogy* of how successful teachers teach has changed from Apprenticeship → Didacticism → Interaction. The Pedagogy factor identifies the major transitions teachers have made in order to teach children. From the comfort level of teaching a single apprentice your trade, to leading a classroom of students from a teacher-led model working towards a student-led model.
- Factor 5, the student *Assessment* has changed from Observation → Testing → Embedded Assessment. Assessment practices have significantly changed from duplication of trade skills, to summative district/state/national performance tests, and now to embedded formative assessment designed to make regular classroom adjustments.
- Factor 6, the *Location* of learning has drastically changed from Home → School → Anywhere. The locations where students learn had shifted from the workshop,

to educational institutions, and now with access to the Internet, can occur virtually anywhere.

- Factor 7, the *Culture* of with whom the students learn has also changed from Adult → Peer → Mixed-Age. Before the Industrial Revolution, children learned from the adults around them. They were the apprentice to the master and developed few peer level relationships. Once the Industrial Revolution had its effects on public education, students had more and more peer relationships. This peer culture had values and expectations that varied from the adult culture. New models of learning including home school, online learning, and the trend towards lifelong learning, now help to reduce the effects of the peer culture. Often in these models of learning, students are exposed to a mixed-age setting that may consist of children, adolescents and adults.
- Factor 8, the *Relationships* have changed from Personal Bonds → Authority Figures → Computer-Mediated Interaction. In the era of internships, the master and intern developed a strong bond. These bonds were not necessarily transferred into the new Industrial Revolution schools. Depending on their family's experiences, some students automatically give authority to teachers, while other students always question authority and require that the teacher earns authority. Too often, it is the struggling student who resists the automatic authority of the institution, and this can have a drastic impact on learning. Researchers like Ron Ferguson (2002) emphasize the importance of these student-teacher relationships as a factor in improving learning for these students. Additionally, computers now being used can provide regular scripted feedback.

Due to the loss of relationships, the use of computers works best with a community of learners.

The dramatic shift of the American economy has had a direct relationship to the learning establishments used to teach our students. There was a time when learning only a specific trade was what one did to succeed and to carry on the family business. There is still a place for this mastery level work, but the changes in the education system due to the Industrial Revolution made mastery a secondary step, requiring all students to have the same basic education. The Information Age has brought about yet another level of learning, empowering students to learn nearly anything they choose. There still are classrooms in which every student receives only a basic education, and everyone doesn't have access to apprentice with a master. Now it is the teachers' time to change their methods so that all children leaving the classroom have the ability to learn whatever is required for the new economy. We often hear that we are preparing students for jobs that do not currently exist; therefore, the only way to prepare them is to bring technology use and problem-solving skills into the classroom. Only then, can we prepare our students for the uncertain future.

History of technology in the classroom (1920s to 1970s). American classrooms have had a breadth of technology used throughout the years (Cuban, 1986). The adoption of technology during any given period mirrored what was being used outside of the classroom by business and the government. Once the new technology was part of the social structure, it was the schools' responsibility to bring that into the classroom. This might be considered a reactive response rather than a

proactive response, as the technology was often adopted for the classroom after its use was deemed necessary to the growth of the economy.

There has been a variety of phases of classroom technologies that coincide with the latest and greatest technology of the time. The first historical phase to technology in the industrial era classroom is the use of film. Film had been used in the form of photos and slides, but the true innovation for the classroom was motion pictures. The first use of motion pictures was 1910 in Rochester, New York public schools, and it was here that film technology was first adopted by the school board for regular instructional use (Saettler, 1968). Using film had the ability to modernize the classroom with its silver screen, projector and black out curtains, and this created a new environment for learning. Though the idea of using film in the classroom was very promising, the evidence shows that most teachers used the technology infrequently in the classroom. The low use of film may have been a result of inaccessibility, the expense of films and equipment, limited content or even lack of teacher knowledge in the use of the equipment.

One area of great success in the use of instructional films was with the training of the US military. With the uses of training videos, WWII was significantly affected by how fast America was able to train recruits. “We had everything calculated perfectly except the speed with which America was able to train its people. Our major miscalculation was in underestimating their quick and complete mastery of film education” (Olsen & Bass, 1982, p. 33). The use of film proved its potential in the military, but was much less effective in public education.

In 1920 the radio division of the United States Department of Commerce began licensing commercial and educational stations. From the 1920s to the 1950s, educators looked at radio to become a new tool that was capable of reaching outside of the classroom. Haaren High School in New York is accredited as the first public school to use a radio in the classroom in 1932. About the same time, other schools started dedicating half hour blocks to educational content in penmanship, arithmetic and history. In 1932, Darrow, the author of the book *Radio: The Assistant Teacher* proclaimed "the central and dominant aim of education by radio is to bring the world to the classroom, to make universally available the services of the finest teachers, inspiration of the greatest leaders... and unfolding world events which through the radio may come as vibrant and challenging text books of the air" (Darrow, 1932, p. 79). Similar to the use of film, radio had some of the same issues with hardware accessibility and teacher use. The goal was to have one radio in every classroom, which never came to fruition. As a result, students often tried to listen in auditoriums, but the sound quality limited the size of the audience that could legitimately hear and understand the broadcast. The receivers that schools did have required significant upkeep in order to function. One major issue was that the batteries, which were needed to run the equipment, needed maintenance and eventual replacement.

In the 1930s battery-less receivers were introduced to the classroom and were also becoming more affordable. Still, teachers had to work with limited content and had to plan around the schedules of the radio stations' broadcasts. This forced radio programs to only be a supplemental component to a child's education. In a 1941 Ohio study of school principals, they found that the reason that 69% of those not using a

radio in the classrooms was because they had unsatisfactory or no radio equipment to use. When you look at radios, you can see that there are similarities to film in why they were not used in the classroom. Eventually, the radio stations, universities, and schools would discontinue broadcasting educational channels. By the 1950s, radio had not become the "textbooks of the air" (1932, p. 79) as Darrow had envisioned, but there would be another new technology to follow radio.

In 1953, the Federal Communications Commission allocated 242 TV channels for educational use. With the increased criticism of the quality of education across the nation, The Ford Foundation took the opportunity to invest over $20 million by 1961, using its Funds for the Advancement of Education program. The support by The Ford Foundation provided a significant boost to the adoption of instructional television compared to the lackluster adoption of both film and radio. In 1962, President Kennedy and the Congress of the U.S.: Office of Technology Assessment (1988) appropriated another $32 million into the development of classroom television and, by 1971, over $100 million had been secured from the public and private sectors.

Instructional television started providing three types of programming: Total Instructional programs, Supplemental Television instruction, and Television as a Teaching Aide. The titles show the varied level of teacher involvement from that of a supervisor using the video to teach, to integration between teacher and television instruction time, and finally where the teacher is most involved and only uses a segment of a video as deemed appropriate. These levels of use align with the shortage of teachers in the 1950s, and the realignment as teacher shortage issues eased in the 1960s. Though access to TV technology has been at higher levels than that of film and

radio, still teachers are found to be reluctant to adopt the technology. Unlike film and radio, instructional television was more universally accessible due to the millions of dollars invested. Still, little has changed in the use of any of these technologies from the day they were available to the day teachers stopped using them.

What has been found with nearly every adoption of new classroom technology is minimal use by teachers to improve student learning. The problem cannot be the same for each type of technology, so there must be some other common problem. One significant purpose for the introduction of all of these technologies was to reform education through innovative approaches. Computers and related technologies are the latest technological aides that are being introduced in mass into classrooms across America.

Reforming school with computers. The use of classroom technology has been a component of school reform since the 1980s (Cuban, 2001). A loose coalition of politicians, corporations, vendors, policy makers and parents have worked together to bring technology into the classroom over the past three or four decades, and they have had three goals that they believe if implemented, would transform classrooms across the nation.

Goal 1: Make schools more efficient and productive than they currently are
Goal 2: Transform teaching and learning into an engaging and active process connected to real life
Goal 3: Prepare the current generation of young people for the future workplace

The coalition has many partners with different forces driving them to technology as a reformation solution. Some are concerned about equity with all students, while others

are looking to solve societal problems that have yet to be resolved. Still, others are looking at the profitability of selling their hardware and software to an expanding new market. They have seen the changes in productivity that technology has brought to the business sector, and want those same changes in education. If they could only make schooling as efficient as working, then schools would truly be changed. Every school would be managed better using business systems, and teachers could expand student learning by increasing the resources available for use in the classroom. Meeting their first goal by being more efficient and productive would be seen as a success through the eyes of business leaders.

The coalition also looked to technology in the reformation of classrooms from a teacher-centered approach, where the teacher provided the knowledge, to the students in a constructivist approach, where students construct their knowledge. In the reformed classroom having this new access to digital resources, students would be inspired to learn. Having access to knowledge beyond the classroom walls, these digital tools could allow students to be more motivated to delve deeper into subjects that they may have never been interested in before. This new approach allowed teachers to become less like drill instructors and more like coaches, something the coalition viewed as essential for student learning in the 21st century.

The biggest reason to have technology in the classroom was to prepare students for the jobs that would be available in the changing job market. The coalition saw that technology was becoming an integral part of the best-paying jobs, and if students were going to be successful (regarding having the highest paying jobs), then they needed to have the technical knowledge and skills to be prepared for the workforce of tomorrow.

By reaching these three goals that were set in the 1980s, schools would have gone through a significant reformation, using technology as the catalyst for change. After a decade of work, the coalition had built up credibility and affected national policy. In 1996 a National Education Summit was held at IBM where governors, corporate leaders, federal officials, and educators heard President Bill Clinton address the importance of academic standards, testing, and technology. This speech by President Clinton brought all of the coalition's goals into one sentence.

> We are convinced that technology, if applied thoughtfully and well-integrated into a curriculum, can be utilized as a helpful tool to assist student learning, provide access to valuable information, and ensure a competitive edge for our workforce. (Archer & Walsh, 1996, p.13)

In the economic expansion of the 1990s, school districts used local, state and federal funds to build up the infrastructure within their schools. In 1996 President Clinton allocated $5 billion from the Technology Literacy Challenge Fund for 5-year grants. At that time President Clinton challenged the nation with four pillars of achievement (United States Department of Education, 1996).

Pillar 1: Modern computers and learning devices will be accessible to every student
Pillar 2: Classrooms will be connected to one another and to the outside world
Pillar 3: Educational software will be an integral part of the curriculum – and as engaging as the best video game
Pillar 4: Teachers will be ready to use and teach with technology

Pillars 1 & 2 are about student and teacher access to technology, while Pillars 3 & 4 acknowledge the use of said technology. The policy makers assumed that if the basic needs were meet with Pillar 1's equipment and Pillar 2's networks, then teachers would fully implement technology into every classroom using Pillar 3's software and Pillar 4's readiness. Throughout the past two decades, millions of dollars have been fed into district technology systems. Now that the technology in classrooms is similar to technology use in many occupations, teachers have yet to embed it into daily teaching practices. The first three Pillars have seen great advancement with equipment purchases and the increase of Internet-based software. This focus has not created the desired results, showing the need to focus on the fourth and final Pillar, preparing the teachers to implement technology efficiently and effectively in their classrooms.

Stage of instructional evolution using technology. In 1985 several districts around the country joined with Apple in the Apple Classroom Of Tomorrow (ACOT) research project (Dwyer, 1994; Ertmer, 1999). The project goal was to introduce technology into several schools so that teachers and students would have constant access. In an analysis of the first four years of the project, several instructional changes occurred in the ACOT classrooms. Through this research, they were able to identify five phases of teacher development in the use and implementation of classroom technology: Entry, Adoption, Adaptation, Appropriation, and Invention.

Before this project, teachers were using the traditional text-based curriculum in a lecture-recitation-seatwork model. These methods were first to be enhanced by technology and then gradually to become a more dynamic learning environment for the students. The ACOT teachers, much like today's teachers, grew up with a fundamental

belief system of what traditional schooling looks like. Consequently, their prior experiences as students and teachers and the required change using new methods of content delivery created an inner conflict. This conflict affected their beliefs in how classrooms are and how classrooms should be. This conflict, and the process of working through these issues is identified by these five phases of teacher development. In the first year, the physical difference in the classrooms was dramatic; technology was abundant, and classrooms were changed. Eventually, over the four years, ACOT eventually developed a bias towards constructivism, though teachers made this change at their own pace.

Entry is the first phase and was apparent when the project just started. The classrooms were text-based, and the tools that the students used were the blackboard, textbooks, worksheets and the overhead projector. The teachers had little-to-no experience using the new computers, and were used to having students arranged in rows or clusters. When all the technology was installed, teachers found the experience to be just like it was their first year teaching. Teachers with years of experience were facing discipline problems, classroom management problems, they couldn't manage their resources, and they were just frustrated. Just trying to be connected was a challenge. This is the typical entry level phase, where the teacher is simply overwhelmed.

The second phase is Adoption, where no longer was the concern being connected with the familiarity of the computer's problem. Now the concern went to the instructional use of the computers. The adoption phase is often your teachers seeing the technology as a support to their text-based curriculum, where the drill and kill tasks

can be transferred to a digital format rather than worksheets. In the study, they found that teachers were used to their old methodologies and that those methods showed success on standardized tests. The teachers were less willing to trade the unknown result of the new technology for what was already identified by their districts as successful. This was in part due to the policies requiring maximum effectiveness that districts had in place, which the teachers already believed they had achieved. There was also significant destruction in the classroom as teachers were changing their instructional strategies and while both teachers and students were mastering the use of the computers. For the teachers going through this phase, the study found that their students achieved just as well as without the technology, and that their self-esteem and student attendance had increased. This was a positive outcome for the ACOT teachers to build on.

Adaptation is the third phase that ACOT teachers experienced. Productivity and writing emerged as two major themes in this phase. Students' speed in completing computer-based activities had increased so much that more time was now available for the teacher to engage students in high-order thinking and problem-solving challenges. Even though the time required to complete coursework was reduced, student test scores were maintained. Students also had acclimated to writing on computers and were writing with more fluency due to their developed keyboarding skills. The digital nature of writing on a computer made writing more presentable and allowed for much easier editing. Students were more willing to revise and edit their papers as compared to paper and pencil writing. This new level of writing also required teachers to develop new strategies in instruction delivery, feedback and

evaluation. Overall, the adaptation phase could be identified with high-quality student engagement where students would be driven to complete their schoolwork anytime during the day.

The fourth phase is the Appropriation, which is where the teacher now understands the technology and can use it effortlessly to accomplish tasks in the classroom. Of note are studies by Becker (1987) and the Congress of the U.S.: Office of Technology Assessment (1988), which indicates that they have seen very few classrooms outside of this project in the appropriation phase. A real shift of instructional practice, the shift to team-based and project-based instruction, occurs in this phase. The teachers are now facilitators and observe their students learning. What the ACOT teachers noticed was that the students changed from being competitive to being collaborative and that their actions helped each other to learn. No longer was the teacher the only dispenser of knowledge; now it was also the students who were teaching. Teachers could now step back and observe a student's peer interactions, and assess knowledge through multiple measures.

The final phase, Invention, was left open by the study to allow for increased growth beyond the appropriation phase. More time would be needed in order to see what experiences students and teachers would have using classroom technology. John Dewey believed that experience is what moves one from a traditional model to a progressive model in education. The “experience continuum [is used] in every attempt to discriminate between experiences that are worthwhile educationally and those that are not” (Dewey, 1963, p. 33). In David Shaffer’s revisit of Dewey’s philosophy, he found that education in the knowledge economy will likely need to resemble work in the

knowledge economy, just as education in an industrial economy reflected industrial work (Gordon, 2001). This is because the knowledge economy is built on the value placed on innovative thinking, and that to build great innovators, students must learn by doing in real life context with appropriate support (mentors). The invention phase may be when the walls of the classroom become more permeable as teachers engage students with outside experts. Though this phase was only identified by the ACOT researchers, there is no doubt that teacher innovation will be the driving forces behind the invention phase.

First- and second-order barriers affecting teacher innovation. The concept of organizational change is an interesting topic when looking at teacher innovation. Parsons and Platt (1973) explored the dichotomy of organizational change vs. organizational stability and found that stability depends on reactions to internal and external forces. In essence, stability requires change. Watzlawick, Weakland, Fisch and Fisch (1974) further enhanced this internal/external idea by introducing first-order change and second-order change.

First-order changes are adjustments to current practices to correct deficiencies in policies and procedures. First-order changes make small changes to make the system more efficient, while maintaining the underlying beliefs of the organization (i.e., using a computer instead of a worksheet for skills review). This assumes that the goal and structure are desirable and should not be changed. Second-order changes on the other hand directly confront the fundamental beliefs of the existing system and look to introduce new methods in order to transform the organization (i.e., electronically conversing with an author to explore the context of a book rather than write a book

report). Brickner (1995) took the concepts of first and second-order change and sought to find the barriers that prevented change. He titled these first and second-order barriers.

Brickner (1995) found that these barriers affect a teacher's innovation implication efforts. He found that first-order barriers were more extrinsic and included things like lack of time, lack of access to the technology, and lack of training/support to use the technology in the classroom. These are fundamental basics that all teachers need in order to integrate technologies effectively into the classroom and are therefore more easily recognized and resolved. He also found second-order barriers that were intrinsic values. These are the beliefs teachers have about the use of the technology in the classroom. Brickner found that the second-order barriers were much more difficult to identify and required major changes to teachers' beliefs and daily practices. The second-order barriers could be fixed, but not with time and funds like first-order barriers.

Brickner (1995) also found that if a teacher identified with multiple first-order barriers, they might become extremely frustrated, especially if that teacher's need was to be fully prepared. Multiple perceived barriers may have prevented most teachers from integrating technology over the past century. Some technology companies recognized these first-order barriers and attempted to remove them so that schools could focus on the second-order barriers. A good example of this was in 1983 when Apple introduced the Apple School Bus connected classroom and the Apple Classroom of Tomorrow. Today we have new and different barriers, so the challenge is how to remove these barriers so that teachers can effectively use classroom technology.

Strategies for addressing barriers. Little has changed in how schools use technology even with the increased access and decreased price of technology (Cuban, 1993; United States Congress: Office of Technology Assessment,1995). Now that both the extrinsic and intrinsic barriers have been identified, one must look at how to address these two types of barriers. Peggy Ertmer (1999) has identified the following strategies that educators can use to overcome these barriers: (a) Develop a vision, (b) Identify curricular opportunities (c) Obtain Resources (d) Manage Resources and Classroom Activities (e) Assess Student Learning. Ertmer proposes that different strategies are required to solve different first and second-order barriers. There is also no need to solve first-order barriers before second-order barriers, but to address the barrier simultaneously using multiple strategies. The order presented here reflects the most typical order in which teachers must address their barriers. Though some of the strategies require others to participate, the goal of these strategies is to empower teachers to address the challenges and know what to reasonably expect from others.

Develop a vision. When a teacher is taking on the use of technology to reach a district's intended educational goals, one of the most important things they can do is to develop a vision. The Office of Educational Research and Improvement finds that "most teachers will find little incentive to tackle the technical and scheduling problems associated with technology (first-order barriers) unless they have a clear vision of how the technology can improve teaching and learning" (Means & Others, 1993, p. 85). The vision that they have will guide and direct them to develop achievement goals. These goals are a combination of both individual teacher goals and a unifying set of teacher

and administrator goals. Three main strategies can be used to develop this common vision: modeling, reflection and collaboration.

Teachers need multiple opportunities to observe the use of integrated technology, either by observing other technology-using teachers, or by participating in staff development with live classroom demonstrations. Being able to see classroom technology in use allows for them to understand the basic components of integrating technology, while also being able to envision their classroom. Teachers also need the opportunity to reflect on their use of technology. "When teachers engage with each other in ongoing reflections about their use of instructional technology, they are more likely to critically evaluate their practice and redesign instruction to better meet student needs and curricular goals" (Persky, 1990, p. 37). This can only occur if teachers are given time to regularly reflect. Reflection can be enhanced through publishing their idea for continued feedback. Finally, the third strategy to create a common vision is to collaborate with on-site colleagues. This allows the team to continue the development of a common vision and to compare their progress with that vision. Collaboration time empowers them to envision what their classrooms will look like, and then to achieve that vision with the implementation of the available technology. With a clear vision, teachers know where to start and what goal they want to reach, having guideposts to keep them aligned along the way.

Identify curricular opportunities. Another strategy that teachers can use in addition to developing a vision is to identify areas in the curriculum that allow for the easy integration of technology. Many training programs prepare teachers to implement a specific technology, when what teachers need is the ability to insert the technology

into a specific lesson. Instead of knowing just the mechanics of software tools, they need to know and see how that tool supports student learning. This inherently requires teachers to redesign lessons to intentionally integrate technology. Means and Olson (1997) suggest that there are three methods to implement classroom technology to support existing curricular goals: a) utilize appropriate software, b) adapt an existing comprehensive multimedia program or c) design an instructional unit using a variety of technology applications. Each of these methods has its advantages and disadvantages, and each method could have its own first and second-order barriers. For example, access and cost could limit availability to use existing tools, while limited time and skill set could prevent developing ones' units. Working collaboratively with others can help bridge these gaps allowing for a teacher to start implementing technology.

Obtaining resources. Lack of resources can place a constraint on teachers such that they are unable to integrate technology into the classroom. The literature suggests that there are four major constraints: Access, Time, Training, and Support. Many teachers lack the access to technology either due to limited hardware availability or lack of proper schedule implementation. Teachers need reliable access to technology in order to prepare for technology integrated lessons. They also need the time to develop new skills sets, explore potential classroom resources, and identify new technology-based tools that can be meaningfully used in the classroom. These opportunities allow teachers to broaden their view on the use of classroom technology, and allow them time to create new and exciting lessons. With these new ideas comes the need for training (either for personal learning or training and conferences). Fisher, Dwyer and Yocam

(1996) recommend that training are both pedagogical and technical, and mirror experiences that they expect to use in their classrooms. Training should be ongoing and evolve with the needs of the teachers, schools and district. Finally, teachers need multiple levels of support from professional, technical, and instructional experts. Each teacher will have varying needs from each of these support areas, but knowing that they have support in each will allow them to confidently explore on their own, knowing that there is always a support structure to back them up.

Managing resources and classroom activities. Classroom management in a technology infused classroom is critical as teachers transition from a teacher-lead environment to a student-lead classroom. Good management will support technology integration by allowing teachers to address other first and second-order barriers, while poor management will limit meaningful opportunities due to these same barriers. Classroom rules for using technology are a must, and can also be used to create a more open and inviting environment to lean towards student-centered learning.

Assess student learning. Assessment is always important so that a teacher knows where each learner is in the learning process. Technology use forces teachers to use multiple means of measurement including rubrics, portfolios, teacher and peer feedback, as well as specific performance tasks. As a result, teachers must learn to use these new tools to evaluate, while also considering the students' self-evaluation. Learning when using computers is very different for different students. Teachers' assessment processes need to address both the curriculum goals and the individual's learning goals. This extends the traditional assessment beyond just student knowledge

to now assess their skills, disposition and attitude. These are areas not typically measured in the paper and pencil classroom.

In summary, the integration of technology into the classroom is very challenging, yet is an aspiration (or requirement) for many teachers. There are certain barriers that one must overcome, and there are many strategies to meet these challenges. Most teachers are going to face multiple barriers when they first start to integrate technology into their classrooms. Throughout this process, there is the underlying belief in oneself as a teacher. The next section will look at teacher self-efficacy, and what additional implications that have on the meaningful integration of technology into the 21st-century classroom.

Current Educational Setting Background

The recent adoption of Common Core State Standards (CCSS) by nearly every state (ASCD.org, 2013) has quickly made classroom technology a major part of the learning environment in almost every K-12 classroom (Ed Week, 2011). Districts are now adopting technology at a rapid rate (Logan, 2013), and are developing technology implementation models that involve the use of tablets, netbooks, laptops or any combination of technologies that can be used to enhance the curriculum, while allowing for the development of students' skills in the underlying technologies. A major goal of No Child Left Behind (NCLB) is to have every student succeed regardless of his or her situation and background (New America, 2013), and districts are using technology to help close these various achievement gaps. The Common Core State Standards developed by the National Governors Association (NGA) and Council of Chief State School Officers (CCSSO) are the latest attempt to reach this goal and meld the teaching

skills of each state and the nation as a whole. There is great potential when bringing together the power of technology, the experience of teachers everywhere, the desire for all students to succeed and the focus on preparing students for STEM (Science, Technology, Engineering and Mathematics) based careers in the United States. This potential to mold students into successful individuals has been hindered in the past by the accountability systems developed for NCLB.

The standardized testing that has been developed and used by each state over the last decade has (or will be) significantly changed with the implementation of Common Core State Standards (ETS, 2013). Traditionally these assessment systems have been paper and pencil based with a significant portion, if not all of the questions, being multiple choice, so that student answer documents with bubbles can be efficiently graded. With over 6 million students in California alone, the use of multiple-choice answers made sense but has often led teachers, schools, and districts to 'teach to the test.' The Smarter Balanced Assessment Consortium (SBAC) and The Partnership Assessment of Readiness for College and Careers (PARCC) are developing the new assessments required by the CCSS. These tests will instead be technology-based, allowing the program to adapt to the user's level and precisely identify his or her mastery of specified skills (SBAC, 2013; PARCC, 2013). Advancement in technology (including affordable access) has allowed systems to be developed that will be able to analyze student results in more ways than simple A, B, C or D choices. Additionally, longer case study type problems will be used which will require a hands-on, multiple teacher approach, to provide a complete and comprehensive score for students. These technology-enhanced assessments will start at the third-grade level and go through high

school, requiring students to be adept at using technology by testing day of their third-grade year. F the test to accurately assess one's subject level mastery and not one's technology skill level, every student must be adequately skilled at using the district technology as selected by the assessment team, which may vary from district to district (CDE, 2012). The role of preparing each student rests on the teachers and administrators who will lead them from knowing numbers 1-100 to their success in college and career.

Teachers are now beginning to teach students the use and purposes of technology at an earlier and earlier age, partially due to the new standards and expectations, but also because our new kindergarten students may have already been using touch-based technology for several years (Kessler, 2011; Ward, 2013). The skill sets of students are ever increasing, while the demands on their technology skills and use of varied technologies also expand (Web Wise Kids, 2013). The expectation that all students will be prepared for technology-enhanced assessments will likely mirror the requirements for them to advance in whatever career path they choose. Educators, students' peers and one's pure personal desire are likely going to be the sources for developing technological skills in each student. Districts will need educators with the desire, skill set and perseverance to lead students in the development of new skills (in subject matter and technology), and hopefully, inspire the desire to learn.

Some school districts are already piloting tablets, netbooks or laptops in a single classroom, at a certain school, or with a specific age group. Other districts have already adopted the use of technology by their students in 1-to-1 settings over several grade spans, and a few have done so for many years. Those districts that implemented a 1-to-

1 program several years ago have been on the cutting edge of incorporating technology into the classroom, taking the chance during a siege of budget cuts over the last decade. These school districts that have already adopted an extensive use of technology (instead of the familiar 4 to 5 classroom desktops for a whole class) can help lead the technology programs of up and coming districts. Their experience will help other districts forge into the age of the technology rich classroom, not purely with software and hardware decisions, but also with the selection of the teacher, the classroom leader responsible for integrating technology and preparing students for life beyond school. Additionally, in the coming years, many older teachers will be retiring while, at the same time many teacher preparation programs are struggling to produce enough high-quality teachers to fill these vacant positions and new teaching jobs (Singer, 2013). For California, the Teacher Shortage Areas Nationwide Listing (ED.gov, 2014) has identified shortages in the following areas: English/Drama/Humanities, Foreign Languages, History/Social Science, Mathematics/Computer Education, Physical Education/Health/Dance, Science and Special Education. School districts around the country will need to fill teaching positions with not only the most highly qualified teacher in specific subject matter, but also those with the skill set to integrate various types of technology into the classroom, with the expectation of increased learning by every student.

Teacher Self-Efficacy

The concept of self-efficacy evolves around ones' perception of themselves, and their belief in their ability to affect change. Self-efficacy is about how one sees themselves and their ability to accomplish a task in relation to the completion of said

task. Self-efficacy can be a predictor of success based on prior experiences or can affect performance regardless of past experiences (Bandura, 1977). Poulou (2007) connected the concept of self-efficacy with teaching and found that beliefs come from the internal rules teachers follow in making instructional decisions. As discussed in the following sections, the sources of self-efficacy help to build one's perceptions of their ability, and these perceptions can become predictors of behavior and the eventual outcome. "People's belief in their efficacy affect almost everything they do: how they think, motivate themselves, and behave" (Bandura, 1977, p. 53).

Teachers' self-efficacy. Teachers are especially vulnerable to issues related to self-efficacy. As they enter the profession, they may feel well-prepared by their formal schooling and then find themselves struggling in the trenches. Programs like BTSA (Beginning Teacher Support and Assessment) in California provide a support structure in the first two years so that teachers can build up their confidence in their teaching ability. Building up teachers' belief in themselves may take several years as they experience teaching the curriculum over multiple years. An educator who teaches the same subject for several years may have the ability to build this belief in himself more easily than a teacher who is moving from grade-level to grade-level or subject to subject. In a study of the literature, four areas were found to be major points of discussion that relate to teacher self-efficacy: Attitude, Strategies, Teaching, and Student Achievement. These four areas will be discussed in this and the following two sections.

A teacher's confidence in their ability to teach is often visibly portrayed by their attitude (Ashton & Webb, 1986; Coladarci, 1992; Woolfolk Hoy & Hoy, 2009). Self-

efficacy is the belief in ones' positive effect on student learning and the belief that even the most difficult students are reachable and teachable. This belief is portrayed by their attitude toward each and every student, and is often a sign of their commitment to teaching. A teacher's attitude shows their belief in herself and in their effectiveness as a teacher. This belief also affects the strategies that they use in the classroom. A more confident teacher is potentially more willing to adopt new technology, for example, and this confidence will affect their ability to innovate and change the classroom (Bandura, 1995; Fuchs, Fuchs & Bishop, 1992).

A teacher's self-efficacy is also linked to the use of effective classroom management strategies and therefore to their success as a teacher (Ashton & Webb, 1986). Many strategies exist depending on the goals and resources of the classroom. With many more schools implementing technology, a more student-based approach is often being adopted by teachers. In these settings, a teacher's belief in their ability to maintain a productive classroom will enhance or restrict the use of this technology. Teachers may also have different levels of self-efficacy based on the subject matter or content area (Tschannen-Moran, Hoy & Hoy, 1998). Their belief in the ability to teach a subject or use technology can certainly bring positive or negative emphasis to a specific subject or tool. A teacher's belief in what the future will look like affects all of the students' experiences in the classroom. For example, if a teacher believes that students cannot cut out paper shapes for an activity without hurting themselves, then the teacher may provide pre-cut shapes or skip the activity entirely. Teachers may not even be aware of their beliefs (Kagan, 1992), and how these feelings affect their goals and aspirations (Anderson, Green & Loewen, 1988; Ashton & Webb, 1986).

A teacher's self-efficacy, or belief that they can teach everything a student needs, can be a strong predictor of student achievement, especially for younger students (Anderson et al., 1988). Older students may have developed their own level of confidence, learning how to learn without the support that a younger student needs, and may have developed their own motivation for learning (Ashton & Webb, 1986; Gorozidis & Papaioannou, 2011). This student self-efficacy leads to higher achievement that is led by the student and not the teacher. These students will likely succeed with or without a teacher who has a high belief in their own ability to teach, but what about those students who have not developed that level of confidence in themselves.

Low self-efficacy in teachers (burnout, distrust to apply tech). Teachers with low self-efficacy face many challenges themselves, and create additional challenges for students. Their attitude can undermine student cognitive development based on their own teaching challenges (Siebert, 2006). Instead of pushing students to new levels of success, a teacher with low self-efficacy may lack the persistence to have every student succeed (Pajares, 1996). This belief in oneself is lowered further by their lack of accomplishment which creates a weak commitment to teaching (Evans & Tribble, 1986; Schwab, Jackson & Schuler, 1986). To be successful, these teachers will rely on simpler tasks in order to avoid personal failure, while at the same time not meeting the needs of students to make them successful (Dweck, 1999; Pajares, 1992).

Teachers who lack belief in their teaching ability spend less time on academic instruction, which further lowers student progress in learning (Cohn & Rossmiller, 1987; Gibson & Dembo, 1984). Since self-efficacy can vary by subject, teachers will also focus on subjects that they are comfortable teaching (Enochs & Riggs, 1990). This

creates a void in student learning that may never be filled in by future teachers and can challenge the student for years to come. If a student has multiple years of teachers who lack the confidence to teach a subject (say mathematics), then that student has been placed at a disadvantage. Teachers without belief in their classroom management are also mired with problems. Due to this, teachers without this confidence to run a classroom experience exhaustion and burnout and are the most likely to leave the profession (Glickman & Tasmashiro, 1982; Schwab et al., 1986). Leaving may be the best option for these teachers and their students. In a study, negative teacher attitude towards boys and low-socio-economics resulted in lower academic achievement compared to relatively positive attitude towards girls and higher socio-economics, which resulted in higher academic achievement (Auwarter & Aruguete, 2008). A teacher's confidence truly can make a difference in a child's education. Teachers with high self-efficacy have vastly different results when teaching.

High teacher self-efficacy. Teachers with high self-efficacy seem to have a completely different take on teaching than those who lack confidence. These teachers have an enthusiasm for teaching and stay committed when there are setbacks (Allinder, 1994; Guskey, 1988; Schwarzer & Hallum, 2008). They recover quickly when they do face difficulty, and have a greater level of resilience shown with their persistence and effort (Schwarzer & Hallum, 2008; Tschannen-Moran & Hoy, 2001). These teachers feel in control of their career, yet are open to suggestion in improving their practice (Bandura, 1986; Guskey, 1988; Saklofske, Michatluk & Randhawa, 1988; Tschannen-Moran & Hoy, 2001). Teachers with high confidence in their ability to teach their students to maintain a cycle of high efficacy (Guskey, 1988). They are open to using

more strategies, and experiment with more tools/techniques (Albion, 2001). They are also willing to implement innovative programs and try out new strategies that challenge their students to achieve new levels (Bandura, 1997; Guskey, 1988; Saklofske et al., 1988). Teaching with confidence allows teachers to have fun and push their classroom toward new experiences and higher levels of success.

Confident teachers present better lessons, lead more in depth discussions, and manage their classrooms better than challenged teachers (Saklofske et al., 1988). They are always looking for new and better ways to deliver content, and are willing to take the calculated risk of implementing new and innovative programs (Allinder, 1994; Evans & Tribble, 1986). This leads to more engaged students and a more effective and dynamic classroom environment (Gibson & Dembo, 1984; Swan, Wolf & Cano, 2001). In general, these teachers are more organized and believe in their own capacity as teachers (Allinder, 1994; Poulou, 2007). They are confident in their knowledge and skills and seek out new knowledge to fill in their personal gaps (Pajares, 1996). Confident teachers challenge themselves to make students successful and identify their own success with their students' success (Bandura, 1977; Guskey, 1988; Poulou, 2007; Saklofske et al., 1988). This leads to even higher success for all students, as teachers support the more challenging students (Gibson & Dembo, 1984). With such a significant difference between low and high self-efficacy teachers, the question is how we build up this self-confidence. To accomplish that, one must understand how to build up one's belief that they can be a successful teacher and make a difference in every child's life.

Sources of teacher self-efficacy. Albert Bandura (1994) identifies four main sources that form a person's belief about their self-efficacy. These four main sources of influence on developing one's self-efficacy are:

1) one's mastery experiences
2) one's vicarious experiences
3) verbal persuasion
4) one's physiological state.

Each of these four sources of influence has a varying affect on the development of one's self-efficacy. The first and most effective way that Bandura found to create a strong sense of self-efficacy was through mastery experiences. Performing a task successfully will help build self-efficacy. The more often these mastery experiences (a.k.a. successful experiences) occur, the more likely one is to have developed a high sense of self-efficacy. Conversely, inadequate performance on tasks can challenge one's belief, damaging their self-efficacy and belief that they can successfully complete additional tasks. Teachers face these challenges daily with every new or repeated lesson, and their personal perception of success will affect their belief in their ability to teach students effectively.

The second influence on self-efficacy is through vicarious experiences, or seeing other people completing a specific task. In the teaching profession, this is often accomplished through model/master teachers or dedicated professional development. When one has a master teacher or is part of a continuous professional development program, that teacher typically visits other classrooms where the teacher will be presenting a mastery experience. In these settings, the visitor will have a vicarious experience of seeing another teacher's success and, with support, will be able to

visualize taking that success to their classroom. It is not the application of the lesson, but the experience through others that raises one's self-efficacy and belief in oneself that they too can present a similar caliber mastery lesson. Exposure to another's mastery experience is why teacher preparation programs all require student teacher assignments. These valuable months allow new teachers to develop a high level of self-efficacy that they, in turn, can take to their first classroom.

Experiences alone do not shape one's belief in self-efficacy. Additionally, there is the art of persuasion, the third influencing source of self-efficacy. Bandura believed that individuals could be persuaded that they had the capacity to succeed in a specific task. Verbal encouragement by peers and administrators removes self-doubt and allows teachers to focus on the task at hand. This task may be presenting subject-based materials, or taking a leap forward and introducing technology into the classroom. The positive praise by others encourages success and builds one's self-efficacy. Poet Maya Angelou once said, "Words mean more than what is set down on paper. It takes the human voice to infuse them with shades of deeper meaning" (1969, p. 98). The power of persuasion can build one's self-efficacy through the support of others.

Finally, Bandura found that one's physiological state can also significantly affect one's perception of self-efficacy. This means that one's mood, emotional state, stress level, and other physical reactions can each affect how a person feels about their ability to complete a task. These physiological aspects can be long-term conditions, or can be situational and depend just on the task at hand. For teachers, sometimes the same task with different groups of students will have differing levels of success. Bandura points out that it is how the individual perceives and deals with the physiological

stressor, rather than the stressors themselves, that affect self-efficacy. Learning how to deal with these issues can better enable individuals to use difficult tasks to improve their self-efficacy.

Maria Poulou (2007) extended Bandura's sources of self-efficacy as she looked at sources of self-efficacy as related to student teachers. The study identified the perceived sources of teaching efficacy including: (a) personal traits including humor, (b) professional skills including organization, (c) the ability to sense student needs, (d) coursework completed, and (e) practical experience. In practice, the study emphasizes the contributory factors of (a) perception of competence, (b) personal characteristics, and (c) motivation, which also play important roles in one's teaching efficacy. The study shows the importance of developing high levels of efficacy in student teachers so that when entering the teacher profession, they have already developed a high sense of self-efficacy that can support them through the first few years of teaching.

Development of teacher self-efficacy. The development of a teacher's self-efficacy begins in learning the pedagogy of teaching and is intentionally sought after during the later student-teacher phase of teacher preparedness programs. The development of teachers can continue for a few critical years in some, and not at all for others. The development of a teacher's self-efficacy begins with the placement of a master teacher. These master teachers will naturally have varying amounts of truly mastery experiences, exposing every student teacher to various degrees of building belief in their teaching ability. Teacher preparation programs make the best placements possible for a given situation. With that being said, the building of self-efficacy must go further than just a few months of student teaching.

The initial placement of a new teacher is a critical aspect of developing self-efficacy. The success or failure of some new teachers can be associated with the first placement of that teacher who has just completed the credential program. Friedman (2000) suggests that in order to build self-efficacy in new teachers, districts should purposefully place them in classes with a smaller number of students and with students who have varying degrees of proficiency. For example, placing a teacher in a class of 35-40 students, who are taking remedial mathematics can have a significantly different effect on the teacher than placing the teacher with 30 average to above average math students. The opportunity exists, according to Friedman, that the second scenario provides many more chances for the teacher to develop a high level of self-efficacy. The likelihood of that teacher maintaining a higher belief in themselves can then be transferred as the teacher moves on to teach more and different courses.

A second significant way to boost a teacher's belief in their ability to teach students is for them to participate in professional development. Educational agencies have "an opportunity not only to improve new teacher efficacy but to enhance the effectiveness of current teachers through their professional development programs...[which] promises to have a significant impact on student achievement" (Levine, 2006, p. 41). There are countless professional development opportunities for teachers to attend every day in every country, state and community. According to Mondie (2009), the challenge is for teachers to attend a variety of opportunities to develop different skill sets. If these skills are not learned in a teacher preparation course, then professional development is the tool needed to bring these skills to each teacher and into the classroom.

In summary, “teacher efficacy is indeed malleable, but that change will likely occur only via engaging and meaningful professional development opportunities, particularly activities such as teacher research initiatives that capitalize on teachers’ critical thought and human agency” (Henson, 2002, p. 144). Without professional development, it can be difficult to gain new skills necessary to feel confident in the classroom. Kennet and Keffer (2006) believe that you cannot complete tasks if you are not capable of completing that task, though confidence in one’s abilities is a strong indicator of future success. Good professional development can provide teachers with skills and confidence, which together can boost self-efficacy.

Assessment Tools

This study will use three instruments to collect data from the respondents. The first instrument will collect categorical information about the participating teachers including grade levels taught, subjects taught, and years teaching. The second instrument will measure teachers’ self-efficacy and will include three factors. The final instrument will measure teachers’ attitude toward instructional technology use in the classroom and will include eleven factors. In combination, 22 factors will be collected for analysis and use in this case study. The factors are as follows:

Efficacy
- *E1 – Engagement*
- *E2 – Instruction*
- *E3 – Management*

Attitude

A1 – Interest
A2 – Comfort
A3 – Interaction-Electronic
A4 – Concern
A5 – Utility
A6 – Perception
A7 – Electronic Mail
A8 – World Wide Web
A9 – Multimedia-teachers
A10 – Productivity-teachers
A11 – Productivity-students

Demographic

D1 – Years Teaching
D2 – Years Teaching in 1-to-1 school
D3 – Self-Directed Learning
D4 – Conference Presenter

Teachers' sense of efficacy scale. The Teachers' Sense of Efficacy Scale (Appendix E) is an instrument developed by Megan Tschannen-Moran at the College of William and Mary and Anita Woolfolk Hoy at Ohio State University (2001). The TSES is designed to measure a teacher's overall self-efficacy (OSTES in reference to the instruments origin from the Ohio State Teacher Efficacy Scale) as well as in three subscales. The three subscales are: Efficacy in Student Engagement (Engagement), Efficacy in Instructional Practice (Instruction) and Efficacy in Classroom Management (Management).

Two surveys were developed at OSU, a short form and a long form. The developers have found that the long form is appropriate for pre-service teachers because the factor structure is less distinct for this group. The short form has been found to work well with experienced teachers and will be used to complete this study. Both forms have questions based on the question "How much can you do?" Each

question asks respondents to choose a value from 1 to 7 on a Likert/Semantic Differential scale. The scale has the following values for each response:

1	Nothing
2	
3	Very Little
4	
5	Some Influence
6	
7	Quite a Bit
8	
9	A Great Deal

In the short form, each subscale is composed of four questions. Engagement is measured by questions # 2, 3, 4 & 11, Instruction is measured by questions #5, 9, 10 & 12 and Management is measured by questions #1, 6, 7 & 8. This 12-question survey instrument will provide valuable information about a teacher's self-efficacy or belief in their ability to engage students, instruct students and manage students. The self-efficacy of teachers has been done using many different tools including the Teacher Efficacy Scale by Dembo and Gibson's (1985) long form and Tschannen-Moran and Hoy's (2007) short form, which are designed to measure Teaching Efficacy and Personal Efficacy, while many other instruments have been designed to measure specific programs. This case study uses the TSES, which uses the methodology of Bandura's Teacher Efficacy Scale, while limiting the factors to three areas: Engagement (E1), Instruction (E2) and Management (E3). These factors will be analyzed and studied to find correlations with factors from the TAC/TAT short form. Permission to use these data collection instruments was granted in writing from Anita Woolfolk Hoy (Appendix D).

Teacher's attitudes towards instructional technology. Rhonda Christen and Gerald Knezek (2009) at the University of North Texas developed the original Teachers' Attitude Towards Computer (TAC) and Teachers' Attitude Towards Information Technology (TAT) instruments. The latest TAC (version 6.01) is designed to measure teachers' attitudes towards nine different aspects of technology (Appendix G). The latest TAT (version 2.01) is designed to measure teachers' attitudes towards five different aspects of technology. There are 14 subscales used to identify one's attitude, and they include: *Interest, Comfort, Accommodation, Interaction (Electronic), Concern, Utility, Perception, Absorption, and Significance, Electronic Mail, Multimedia, the World Wide Web, Teacher Productivity, and Classroom Productivity for Students*.

Shattuck et al. (2011) used confirmatory factor analysis to confirm the validity/reliability of the 95-item TAC and 50-item TAT. Using large samples from three states, the TAC was reduced from 95 to 35-items with eight factors (*Significance* was eliminated due to cross-loading) and the TAT was reduced to from 50 to 20-items measuring five factors, for a total of 13 factors. Additionally, a 42-item TAC/TAT short form instrument was developed and validated by Shattuck et al., with 11 factors (*Interest* and *Absorption* were combined under the title *Interest* and *Accommodation* was dropped). The single TAC/TAT short form instrument not only reduces the number of items from 148 to 42 (making it easier for a teacher to complete the survey), but also provides a single instrument that can be easily delivered to attain information about teachers' attitude towards aspects of instructional technology.

The TAC/TAT short form uses a varying number of questions for each subscale, and also uses three types of response systems. The majority of factors (Interest,

Comfort, Interaction (Electronic), Concern, and Utility) use a Likert/Semantic Differentiation scale with the following responses:

SD (1) = Strongly Disagree
D (2) = Disagree
U (3) = Undecided
A (4) = Agree
SA (5) = Strongly Agree

The Perception factor and revised TAT items each use a systematic differentiation table with three (3) or four (4) pairs of contrasting verbs and five (5) choices between each pair of verbs.

Once completed, this 42-question survey will provide 11 factors for each participant. The factors are Interest (A1), Comfort (A2), Interaction-Electronic (A3), Concern (A4), Utility (A5), Perception (A6), Electronic Mail (A7), World Wide Web (A8) Multimedia-teachers (A9), Productivity-teachers (A10), and Productivity-students (A11). Additionally, Shattuck et al. found that the revised TAC/TAT short form measures three aspects of attitudes towards technology: Affective Reactions (*Interest, Comfort, Concern and Perception*), Technology Usage (*Utility, Productivity-teachers and students*), and Specific Tools (Interaction-Electronic, Electronic mail, World Wide Web and Multimedia-teacher). These factors will then be analyzed and studied to find any correlations with the TSES and Demographic Information collected. Permission to use the TAC/TAT data collection instruments were granted in writing from Mary Ann Muller - Permissions Coordinator, US Journal Division (Appendix F).

Demographic measures. In addition to the sub-categories of teachers' technology skill set and attitude toward technology, this study will also use some

demographic data including*, Years Teaching (D1), Years Teaching in 1-to-1 classrooms (D2), Self-Directed Learning (D3) and Conference Presenter (D4)*. These four factors could also have a significant effect on attitudes and use of technology as well as the development of one's self-efficacy.

Interview protocol. The interview protocol for this study is structured on the guidelines set forth by Creswell (2007, 2009), and they are written to meet the needs of this study. The interview protocol (Appendix C) will be used to guide the interviews and has been written to address the interviewee in a natural conversation. Nine questions have been written to collect data related to each of the three research questions. An additional five follow-up questions are included to learn more if.

Validation of Previously Establish Data-Gathering Instruments

Cronbach alpha score is one on four methods that are generally reliable to measure the internal consistency of a test (Trochim, 2001). Cronbach alpha scores were used to establish the reliability of each instrument used in this study.

Teachers' Sense of Efficacy Scale (TSES): The TSES is an instrument that has been refined from other tools that have been developed to measure self-efficacy. This instrument follows in the footsteps of The Rand Measure, The Webb Scale, Bandura's teacher self-efficacy scale, Ashton Vignettes and Gibson and Dembo Teacher efficacy scale. At Ohio State University, participants of the Self-Efficacy in Teaching and Learning seminar worked to develop a new measure of self-efficacy (Tschannen-Moran & Hoy 2001). Through two separate factor analyses, one for 111 pre-service teachers and one for 255 in-service teachers, the TSES went through three iterations which reduced the number of questions from 52, to 32, 18, and finally to a 24-item long form

and 12-item short form. The results for internal consistency produced through this series of studies for the TSES short form and long form are as follows:

	TSES Short form	TSES Long form
Overall Cronbach alpha	$\alpha = 0.90$	$\alpha = 0.94$
Included factors of:		
Engagement	$\alpha = 0.81$	$\alpha = 0.87$
Instruction	$\alpha = 0.86$	$\alpha = 0.91$
Management	$\alpha = 0.86$	$\alpha = 0.90$

Both the short and long form can be considered reasonably valid and reliable. This study will use the short-form as either form is appropriate for in-service teachers, and all educators surveyed at Chawanakee Unified will fit this category.

Teacher's attitudes towards instructional technology. The TAC/TAT short form is an instrument that has been refined by Shattuck et al. (2011) from TAC version 5.11 and TAT version 2.01 which themselves have been developed over many years by Rhonda Christen and Gerald Knezek (2009) at the University of North Texas. The original Teachers' Attitudes Towards Computer questionnaire was developed in 1995-97 and consisted of 284 items. The TAC has many newer versions: TAC 2.22 (199 items), TAC 3.0 (198 items), TAC 3.2a (105 items), TAC 3.2b (109 items), TAC 5.11 (95 items) and TAC 6.1 (51 items).

The TAC/TAT short form instrument uses TAC 5.11 and the TAT 2.01 which complements the TAC by providing assessment on newer technologies. Shattuck et al. (2011) completed their confirmation of the TAC and TAT and subsequent revision and further refinement to 42-items, using data from 661 respondents from three states (NC, TX and NV). The results for the internal consistency produced through this study for the

refined TAC/TAT short form as follows (revised 35-item TAC and 20-item TAT in parenthesis):

	NC data	TX/NV data
Included factors of:		
Interest	α = 0.84 (0.88)	α = 0.88 (0.89)
Comfort	α = 0.92 (0.95)	α = 0.93 (0.95)
Interaction-Electronic	α = 0.94 (0.94)	α = 0.95 (0.95)
Concern	α = 0.85 (0.85)	α = 0.86 (0.87)
Utility	α = 0.86 (0.87)	α = 0.88 (0.88)
Perceptions	α = 0.94 (0.94)	α = 0.95 (0.94)
Electronic Mail	α = 0.91 (0.90)	α = 0.89 (0.89)
World Wide Web	α = 0.94 (0.93)	α = 0.92 (0.93)
Multimedia-teachers	α = 0.94 (0.94)	α = 0.95 (0.95)
Productivity-teachers	α = 0.94 (0.94)	α = 0.91 (0.92)
Productivity-students	α = 0.94 (0.93)	α = 0.92 (0.93)

The longer revised 35-item TAC and 20-item TAT as well as the refined TAC/TAT short form can be considered reasonably valid and reliable. This study will use the TAC/TAT short form to provide a single, easily administrated instrument.

Summary

This chapter reviewed the existing literature on the adoption of technology by teachers in the 21st-century classroom and the field of self-efficacy. As technology has changed over the past 100 years, districts have been slow to bring these technologies to the classroom. More recently, school boards have been adopting models that incorporate more technology into the classroom, often working toward a 1-to-1 student computer ratio. With these technological enhancements comes the need for teachers who are willing and capable of taking on the innovations. Teachers with high self-efficacy will be needed to take these tools and incorporate them meaningfully into the classroom. Teacher self-efficacy is very relevant to these advancements in technology, as the confidence to incorporate new technology into the pedagogy requires a willing

and confident teacher. Likely, the best place to find this teacher is in the best classrooms, where the teacher is already presenting a high level of confidence in their teaching ability. Teachers who are already successful are likely going to be the best at incorporating technology simply due to their belief that they can. We can learn from their experience and help others to build up their ability to meaningfully incorporate technology in every classroom across the nation.

Chapter Three: Methods

The purpose of this mixed methods case study was to learn the relationships among measures of teacher self-efficacy, attitude toward instructional technology, and possible differences and relationships among select demographic variables, and to understand how these variables correlated with student productivity in project-based learning at Minarets High School. Each of these variables was measured using validated measurement devices. Also, the researcher gathered background information on each participant. A collection of the background information was important to the study to help to identify any correlations and differences between and among grade level taught, subjects taught, or years teaching, and the factors found with other instruments. This study also included one-on-one semi-structured interviews that utilized open-ended questions to better understand the points of views of selected participants. Additionally, assessment data and school artifacts were collected as measures of student productivity.

Research Design

The design of this research was that of a mixed-method case study that sought to find relationships among key variables with individuals or group of individuals (ORI, 2013). A single school district within California was the defined case. A descriptive design with a concurrent triangulation strategy was selected due to the small size of the school district. Bickman and Rog (2008) also suggest that a descriptive case study inherently seeks to describe the world as it is, painting a picture without change, and the descriptive case studies should not be used to identify cause and effect, but seek to identify *what is*, and *what was*, or *how much* questions. Robert Yin (2012) believes that

descriptive case studies “can offer rich and revealing insights into the social world of a particular case” (Yin, 2012, p. 49) and are especially suited for unique one-of-a-kind situations. Yin also identifies a challenge with this type of study as the researcher mediates between describing everything or creating a study that is too sparse.

In this case study, a snapshot in time was taken using survey instruments whose results were studied to find relationships that may exist to further understand the research questions. The mixed-methods approach enabled triangulation of findings of the quantitative data gathered through the administration of two data gathering instruments to be combined with a series of face-to-face interviews. Additionally, no experimental design was applied that changed the environment for the participants.

Restatement of the Research Questions

The research questions were:

1) What teacher and district/school factors allow for effective technology integration? Specifically,
    a. What relationship, if any, exists between teachers’ sense of self-efficacy and teachers’ attitudes toward instructional technology?
    b. What relationship, if any, exists among the factors of teachers’ sense of self-efficacy (Student Engagement, Instructional Practice, and Classroom Management) and Student Productivity?
    c. What district/school factors, if any, promotes the use of technology in the classroom by and for students?

Data Sources

For this study, the data sources were the teachers and administrators working with students and technology at Minarets High School and Minarets Charter High School located in Chawanakee Unified School District. The third source was artifacts of the school and district that provided information about student performance and school success. Additionally, school demographic and the California Assessment of Students Performance and Progress (CAASPP, 2016) data provided a limited look into the success of the students at Minarets High School and Minarets Charter High School.

Survey- data sources: The population for the survey portion of this case study consisted of sixteen grade 9-12 teachers and administrators employed at Minarets High School and Minarets Charter High School of the Chawanakee Unified School District.

Interview- data sources: The population for the interview portion of this case study consisted of nine grade 9-12 teachers or administrators employed at Minarets High School and Minarets Charter High School of the Chawanakee Unified School District. Teachers and administrators were selected by their volunteering to be interviewed.

Artifact sources: Teachers and administrators were asked to identify evidence of student performance. These artifacts of success were identified during interviews and discussions with the administration. Minarets students have been recognized for many achievements, and this form of data collection was the opportunity to identify student and school achievements that may not be easily identified in other ways.

Assessment data sources: Publicly available demographic and assessment data were found at http://caaspp.cde.ca.gov/. These data provided additional data points on student performance and school success.

Process for the Selection of Data Sources

Survey- data source selection process. The subjects for the survey portion of this study displayed the following qualifications for inclusion:

- Serving as a teacher of record in a grade 9-12 classroom

  and

- Teach at Minarets High School and Minarets Charter High School

All Chawanakee Unified teachers employed at Minarets High School and Minarets Charter High School were sought for this study to meet a representative subject size. A list of teachers who meet the qualification criteria listed above was obtained from Minarets High School, and this list was used to contact each potential participant. Authorization to survey the teachers was obtained from the Chawanakee Unified Superintendent (Appendix A). The school administration was in support of this research and encouraged the teachers' participation.

Interview- data source selection process. The subjects for the interview portion of this study were selected purposely in order to best represent administration and a representation of teachers from each department:

- Minarets High School Principal
- Minarets Charter High School Director
- Grade 9-12 teacher, one from each of the following departments:
  - Math Department

- Humanities Department
- Ag/Mechanics Department
- Electives (Media/Music/Information Technology)

All subjects were informed of the recording of their interviews and were provided confidentiality of transcripts and anonymity in reporting of finding.

Data Collection Strategy

Survey data collection strategy. The survey questionnaire included the elements of the previously validated (see Chapter 2) Teacher Sense of Self Efficacy Survey(TSES) and Measuring Teacher Attitudes Towards Instructional Technology Survey (TAC/TAT short form), as well as minimal demographic information. The survey instruments were loaded into Google Forms, which was used to collect the responses. Teachers needed fewer than 30 minutes to complete the~~se~~ survey questions. The factors that were measured through this survey are as follows:

Efficacy
- *E1 – Engagement*
- *E2 – Instruction*
- *E3 – Management*

Attitude
- A1 – Interest
- A2 – Comfort
- A3 – Interaction-Electronic
- A4 – Concern
- A5 – Utility
- A6 – Perception
- A7 – Electronic Mail
- A8 – World Wide Web
- A9 – Multimedia-teachers
- A10 – Productivity-teachers
- A11 – Productivity-students

Demographic

D1 – Years Teaching
D2 – Years Teaching in 1-to-1 school
D3 – Self-Directed Learning
D4 – Conference Presenter

Interview- data collection strategy. The second aspect of data collection for this research was a semi-structured, open-ended 15 to 25-minute interview held in person. Bryman and Bell (2007) found that the data collection strategy of interviewing had advantages over personal observations. The advantages they found were that interviews allowed the researcher to investigate issues that are not easily observed and collect data across a broader range of situations, rather than the single situation in observation. Stake (1995) also makes a similar recommendation and further suggests that a set of questions should be prepared in advance, with limited departures from the protocol. First, interviews should be used over observation, because the researcher will follow an interview protocol to guide the interview, whereas observations are not guided toward the goals of the research. Second, the use of open-ended questions in an interview allows the researcher to guide the interview in the direction of the research study, but also allows the subjects to relate their unique opinions and experiences. Therefore, semi-structured interviews were used to gather the most appropriate information for this study. During the interviews, follow-up questions were asked when needed to better understand the thoughts of the interviewee. All interviews were recorded for transcription. Open-ended questions were used to encourage the participants to go into greater depth.

Pilot study. Before initiating the campaign, a usability study of the recording instrument was run using volunteer participants of the Pepperdine GSEP community.

During this usability study, three classmates were asked to complete the survey instrument designed for this study and asked to provide general feedback. The results served two purposes. First, the data collected were verified for accuracy and compatibility with NCSS software. Second, the feedback of each classmate was considered and used to correct any issues in the instrument to provide the best possible experience for each participant.

Additionally, the interview protocol was validated using volunteer participants of the Pepperdine GSEP community to assure the timeframe was appropriate, the recording method was effective, that the questions were able to collect the information needed for this study and to make sure that all of the procedures were well laid out and sequenced. Practice interviews were scheduled with volunteers to demonstrate the usability of the instrument.

Once everything had passed the usability study, the final instrument was published. With the approval of the high school administrators, staff was given the survey instrument during a staff meeting, allowing for a one-day data collection window for the survey. After the staff meeting, the survey instrument was closed the following day, and data were collected and exported for analysis into NCSS.

Data Collection Procedures

Survey- data collection procedures. The participants received a link at the staff meeting inviting them to participate in an online survey. Once there, they read the included text for informed consent (Appendix B) and then they clicked the link to open the survey. The survey queried participants about their self-efficacy, attitude toward

technology and limited demographic information. Participants entered their responses directly into the online survey. They were permitted to stop at any time without penalty.

Interview- data collection procedures. Following the survey, participants were asked to volunteer to be interviewed. Those who accepted completed a secondary survey to provide their name and indicate their willingness to participate as an interviewee. All willing participants were welcomed to an interview where the Interview protocol (Appendix C) was used to guide the interview. A researcher-created interview protocol was used with open-ended questions to conduct the interviews. Creswell (2007) suggests that when conducting interviews, the researcher should be respectful and courteous at all times and should refrain from offering advice.

All interviews were recorded with a digital recording device. The privacy of the participants was protected through the use of a numbering system, coded to the participants in a single password protected electronic file, and stored in hard copy in a locked safe in the researcher's office. All files associated with the interviews will be kept by the researcher in a password protected electronic file, and a hard copy was stored in a locked safely in the researcher's office.

Description of the Data Analysis Process

This mixed method study included both quantitative and qualitative methods of data collection and analysis. A concurrent triangulation approach (Creswell, 2007) allowed for the researcher to gather both quantitative and qualitative data concurrently, analyzing separately, and then merged to triangulate the data to arrive at study conclusions (see Figure 3.1). As Creswell, Clark, Gutmann, and Hanson (2003) point

out, the use of this design allows researchers to “use two different methods in an attempt to confirm, cross-validate, or corroborate findings within a single study” (Creswell et al., 2003, p. 229).

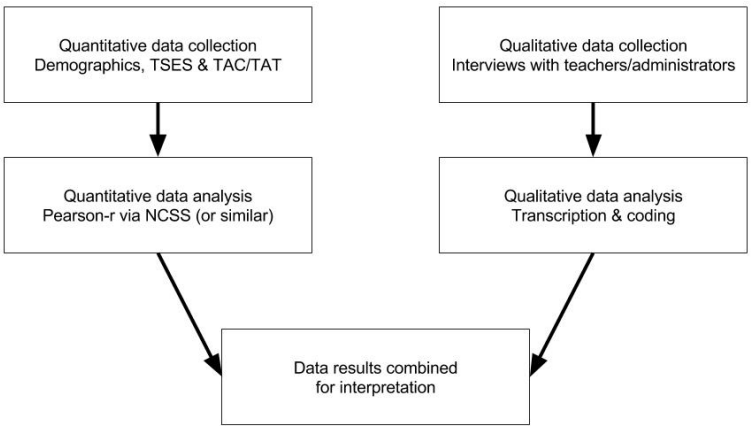

Figure 1. Concurrent triangulation. This figure illustrates the data analysis process used for this research to merge both quantitative and qualitative data sets.

Quantitative data analysis. The survey component of this study used a factor analysis to identify measures of each efficacy and attitude factor. To compute the unweighted means of each factor, the following procedure was used:

Efficacy factors – The three efficacy measures were calculated by combining the score for each item (1-9) and then computing the average score for each factor as follows:

E1 - Engagement: Items #2, 3, 4, 11
E2 - Instructional Strategies: Items #5, 9, 10, 12
E3 - Classroom Management: Items #1, 6, 7, 8

Attitude Factors – The 11 attitude factors were calculated by combining the score for each item (A1-A5 uses a scale from 1-5, A6-A11 uses a scale from 1-7) and then computing the average score for each factor as follows:

A1 – Interest: Items #1-3, 1-5, 8-1, 8-2, 8-3, 8-5, 8-6
A2 – Comfort: Items #2-1, 2-2, 2-4 (reversed, written negatively)
A3 – Interaction-Electronic: Items # 4-2, 4-3, 4-4, 4-5
A4 – Concern: Items #5-3, 5-4, 5-5, 5-6, 5-7 (reversed, written negatively)
A5 – Utility: Items #6-2, 6-2, 6-4, 6-7
A6 – Perception: Items #7-2, 7-3, 7-4, 7-7
A7 – Electronic Mail: Items #tatv14, tatv16, tatv17
A8 – World Wide Web: Items #tatv24, tatv26, tatv27
A9 – Multimedia-teachers: Items #tatv34, tatv,36, tatv37
A10 – Productivity-teachers: Items #tatv44, tatv46, tatv47
A11 – Productivity-students: Items #tatv54, tatv56, tatv57

Demographic Factors – The 4 demographic factors were used as variables in the analysis of the Efficacy and Attitude Factors. Sample data (N=16) revealed several representative groups (as indicated below).

D1 – Years Teaching
Three separate data groups for years teaching are:
1-3 years
4-6 years
10+ years
D2 – Years Teaching in 1-to-1 school
Two separate data groups for years teaching in 1-to-1 school are:
1-3 years
4-6 years
D3 – Self-Directed Learning
Two separate data groups for self-directed learning are:
Less than 1 hour per week
More than 1 Hour per week
D4 – Conference Presenter
Two separate data groups for conference presenter are:
Non-Presenter
Presenter

NCSS software was used to run descriptive statistics, and a Pearson product-moment correlation was used to check for correlations between the efficacy, attitude and demographic factors (NCSS, 2016). Results for each comparison ranged from -1 to 1, where -1 indicates a strong negative relationship and 1 represents a strong positive

relationship. A correlation near 0 indicates the minimal relationship among the two variables.

Qualitative data analysis. The interviews were each recorded, and the first step was to transcribe each interview. Once the recordings were transcribed then the researcher went through the following steps:

1) Step 1
    a. Read all transcripts
    b. Noted first impressions
    c. Re-read transcripts one-by-one
    d. Read transcripts by question
2) Step 2
    a. Coded relevant pieces
    b. Remained Unbiased throughout the coding process
3) Step 3
    a. Selected most important Codes
    b. Created Categories by grouping Codes
4) Step 4
    a. Kept relevant Categories
    b. Noted how Categories are Connected
    c. Gave each Category a Label
    d. Described Connections
5) Step 5
    a. Interpreted Results: New knowledge about the world from the perspective of the participants
    b. Discussion: Researcher's interpretation of the results.

Once the quantitative and qualitative analysis was completed, the researcher looked for connections between them and interpreted the results and identified how all of the sources of data interconnect. Results from this analysis are published in Chapter 4 and followed with a discussion of the findings in Chapter 5.

Institutional Review Board and Human Subject Considerations

This dissertation was submitted to the Pepperdine University Graduate and Professional Schools Institutional Review Board (IRB) to verify protection of the rights and the welfare of human subjects participating in the research activities.

The survey instruments used in this study were set up to anonymously collect the data from each individual. Due to the small size of the school, with even limited demographic data points, there is a limited potential that the data collected could be used to narrow down a set of responses to just a couple of teachers. This demographic data was used to identify administrators or teachers, and to group teachers into relative groups like subject areas and years teaching. The IRB authorization can be found in Appendix I.

Summary

Chapter Three sought to explain the purpose of this study and the methodology that was used. The purpose and research questions were restated, the design of the study was discussed, as well as the population and sample selection process. Finally, the chapter explained the data collection procedures and data analysis processes that were used.

Chapter Four: Findings

This study investigated the relationship between teacher self-efficacy and teacher attitude towards instructional technology in a district that has been rich with technology for many years. With a goal to determine what school/district factors allow for the effective integration of technology, the study used overall factor scores and also examined the results based on four background teacher variables (years teaching, years teaching 1-to-1, hours spent learning new technology skills, and if the participant was a conference presenter) in order to better understand how these factors may contribute to the integration of technology. The participants of this study included teachers and administrators from Minarets High School and Minarets Charter High School, a rural school located in the foot-hills of Madera County. Twenty-two high school teachers and administrators were invited to participate in the study. One strength of this study was 73% survey response rate and that 56% of the participants were interviewed.

The following findings and discussion are based on sixteen usable surveys (*N*=16) and nine interviews (*N*=9). The survey data were analyzed using descriptive statistics to provide a summary of the data set while Pearson-r correlational matrix was used to understand the linear correlations between factors of the data set. The semi-structured interviews were coded and categorized to reveal findings/connections that were not measurable using a survey. Together, the analysis of the survey data and coded interviews were used to answer the research questions for this study.

Restatement of the Research Questions

The research questions for this study were created from a review of related literature and the researcher's prior knowledge of the district, school, and staff. During this study, the following question was addressed:

1) What teacher and district/school factors allow for effective technology integration? Specifically,
    a. What relationship, if any, exists between teachers' sense of self-efficacy and teachers' attitudes toward instructional technology?
    b. What relationship, if any, exists among the factors of teachers' sense of self-efficacy (Student Engagement, Instructional Practice, and Classroom Management) and Student Productivity?
    c. What district/school factors, if any, promote the use of technology in the classroom by and for students?

Sample Data Overview

The researcher's intention was to draw on the majority of teachers at Minarets so that the best snapshot could be created and generalized for other schools looking at integrating 1-to-1 technology-based learning into their schools. In this study, the completion of survey data took place at an all staff meeting allowing access to all possible participants at one time. Table 1 describes the demographic data collected from the online survey.

Table 1

Descriptive Statistics – Survey Respondent's Profile

Demographic variable	Count (Percentage)
Years Teaching	
1-3 years	5 (31.25%)
4-6 years	6 (37.50%)
10+ years	5 (31.25%)
Years Teaching 1-to-1	
1-3 years	10 (62.50%)
4-6 years	6 (37.50%)
Hours Spent Learning New Technology Skills	
Fewer than 1 hour per week	6 (37.50%)
More than 1 hour per week	10 (62.50%)
Presents at Conference	
Non-Presenter	11 (68.75%)
Presenter	5 (31.25%)

Note. N = 16

The demographic data from the survey reveal a variety of levels in teaching experience (from first year teachers to veteran teachers) and also show the limited expertise that they collectively have in teaching with 1-to-1 technology (with only 6 teachers reporting 4 or more years teaching in the type of classroom setting that Minarets provides). Near two-thirds of the teachers spend more than an hour each week learning new technology skills, while a majority of the staff (69%) do not share this knowledge with others by speaking at conference presentations.

At the end of the main survey, the researcher asked participants to volunteer to be interviewed. The intent of the researcher was also to interview a heterogeneous sample of teachers and administrators from Minarets High School and Minarets Charter High School to best understand the underlying school and district factors that allow for

the 1-to-1 technology-based learning that occurs at Minarets. Nine of the survey participants volunteered to be interviewed. Table 2 describes the demographic data collected during the interview process.

Table 2

Descriptive Statistics – Interview Respondent's Profile

Demographic variable	Count (Percentage)
Position	
Teacher	7 (77.78%)
Principal	1 (11.11%)
Director of Charter	1 (11.11%)
Subject Teaching	
English	1 (11.11%)
Math	1 (11.11%)
Science	1 (11.11%)
History	1 (11.11%)
Special Education	1 (11.11%)
Electives	
Leadership	1 (11.11%)
Spanish	1 (11.11%)
Music	1 (11.11%)
Teaching Credential	
Intern	1 (11.11%)
Intern turned Credentialed	1 (11.11%)
Professional turned Credentialed	1 (11.11%)
Credentialed	6 (66.67%)

Note. N = 9

The interview demographics show that a heterogeneous selection of teachers did occur for the interview process. Administrators and teachers were well represented, as well as a wide variety of subject areas that are taught at Minarets. Additionally, the participants covered a variety of credentialing pathways from interns to professionals, or career teachers.

Descriptive Information About Measures

The overall score and subscale scores were examined using descriptive statistics by combining the results from each question into subscale scores, and by combining the subscale scores into an overall score. The mean combined score (M) was calculated aligning with the standard deviation (SD), Minimum (Min), Maximum (Max) and Range for each subscale and overall score. Table 3 describes the descriptive data collected from the online survey.

Table 3

Descriptive Statistics of the Subscales for the Teachers' Sense of Efficacy Scale and Teachers Attitude Toward Instructional Technology

Survey/Subscale	M	SD	Min	Max	Range
Teachers' Sense of Efficacy Scale:					
Teachers' Sense of Efficacy Scale (TSES)	7.17	0.79	5.08	8.42	3.33
Efficacy in Student Engagement (E1)	6.61	0.99	4.5	8	3.5
Efficacy in Instructional Strategies (E2)	7.41	1.31	3.75	9	5.25
Efficacy in Classroom Management (E3)	7.48	0.61	6.5	8.75	2.25
Teacher's Attitudes Toward Instructional Technology:					
Teachers' Attitude Toward Computer (TAC)	3.62	0.31	3.15	4.07	0.92
Interest (A1)	3.67	0.64	2.43	4.43	2
Comfort (A2)	6.52	0.57	5.33	7	1.67
Email (A3)	3.53	0.83	2	5	3
Concern (A4)	5.65	0.63	4.2	6.4	2.2
Utility (A5)	4.60	0.41	4	5	1
Perception (A6)	5.83	1.00	3.5	7	3.5
Teachers' Attitude Towards Info. Tech. (TAT)	5.64	0.81	4	7	3
Email (A7)	4.14	1.51	1	7	6
WWW (A8)	6.25	0.82	4	7	3
Multimedia (A9)	6.23	0.91	4.33	7	2.67
Teacher Productivity (A10)	5.90	1.25	2.67	7	4.33
Student Productivity (A11)	5.54	1.05	4	7	3

Note. N = 16

In examination of the survey responses related to teacher self-efficacy, the data indicate that, as a group, respondents believed that they were self-efficacious. They reported a mean score of 7.17 out of 9 in the overall TSES score and above average scores in two subscales (Instructional Strategies at 7.41 and Classroom Management at 7.48). As a group, they reported the lowest mean score of 6.61 out of 9 in the Student Engagement subscale.

The Teachers' Attitudes Toward Instructional Technology consists of two measures: Teachers' Attitude Towards Computers (TAC) and Teachers' Attitude Towards Information Technology (TAT); both surveys use a Likert scale from 1 to 7. The overall TAC score averaged at 3.62 with a standard deviation of .31, placing the sample in the middle of the scale. The comfort subscale was the highest at 6.52, while the lowest subscale average was email at 3.53. The perception and concern subscales also had high averages (5.83 and 5.65, respectively). The overall TAT score averaged on the higher end at 5.64. The lowest TAT subscale was email (4.14 out of 7), matching the low score on the email subscale of the TAC. Teacher Productivity and Student Productivity subscales were close to the average, while WWW and Multimedia subscales score higher than average. All TAT factors received at least one 7 out of 7 score from the participants.

In addition to the overall descriptive data, several groups have been identified in the analysis of the survey data. The following section looks at more detail into the descriptive data for each of the groupings. Combined, the overall and group data provide a more complete understanding of the data set.

Descriptive Information About Survey Measures, by Demographic Grouping

To better understand the sample group, the demographic data were used to identify several groups. The groups that were identified are:

Years Teaching (1-3 years, 4-6 years, 10+ years)
Years Teaching 1-to-1 (1-3 Years, 4-6 Years)
Hours Spent Learning New Technology Skills (<1hr. per week, >1 hr. per week)
Presents at Conferences (Non-presenter, Presenter)

These groups are used to further explore the differences in the sample data as it pertains to the demographic selections of the 16 participants. This section of the study focused on identifying any findings in the descriptive statistics for each survey (TSES, TAC, and TAT) as related to each grouping. The following tables provide a descriptive look at the overall average score and average score of each group.

The Teachers' Sense of Self Efficacy scale (TSES) measures overall self-efficacy as well as three subscales: Efficacy in Student Engagement, Efficacy in Instructional Practices and Efficacy in Classroom Management. The teachers were invited to score themselves from 1 to 9 on a Likert scale. These self-reported scores represent one's confidence in one's self to engage students, lead student learning and manage students in the classroom. Table 4 shows the descriptive data collected from the online TSES survey and reveals the descriptive data for each of the identified groups.

Table 4

Descriptive Statistics of the Overall and Subscales for the Teachers' Sense of Efficacy Scale (TSES), by Demographic Grouping

	ALL (*N*=16)	Non-Presenters (*n*=11)	Presenters (*n*=5)	Less than 1hr (*n*=6)	More than 1 hr (*n*=10)	1-3 yrs 1-1 (*n*=10)	4-7 yrs 1-1 (*n*=6)	1-3 yrs teaching (*n*=5)	4-6 yrs teaching (*n*=6)	10+ yrs teaching (*n*=5)
Student Engagement										
Min	4.50	4.50	6.50	5.00	4.50	4.50	5.00	4.50	6.50	5.00
Max	8.00	7.75	8.00	8.00	8.00	8.00	7.75	7.50	8.00	7.75
Range	3.50	3.25	1.50	3.00	3.50	3.50	2.75	3.00	1.50	2.75
Mean	6.61	6.36	7.15	6.63	6.60	6.75	6.38	6.25	7.13	6.35
St. Dev	0.99	1.02	0.78	1.13	0.96	1.05	0.09	1.15	0.70	1.04
Instructional Strategies										
Min	3.75	3.75	7.25	7.25	3.75	3.75	6.00	3.75	7.25	6.00
Max	9.00	8.75	9.00	9.00	9.00	9.00	9.00	7.50	9.00	9.00
Range	5.25	5.00	1.75	1.75	5.25	5.25	3.00	3.75	1.75	3.00
Mean	7.46	6.98	8.35	7.92	7.10	7.10	7.92	6.50	7.92	7.70
St. Dev	1.31	1.27	0.89	0.75	1.51	1.33	1.21	1.59	0.85	1.22
Classroom Management										
Min	6.50	6.50	7.00	7.00	6.50	7.00	6.50	7.00	7.00	6.50
Max	8.75	8.75	8.25	8.75	8.50	8.75	7.75	7.50	8.75	7.75
Range	2.25	2.25	1.25	1.75	2.00	1.75	1.25	0.50	1.75	1.25
Mean	7.48	7.41	7.65	7.75	7.33	7.58	7.33	7.25	7.83	7.30
St. Dev	0.09	0.67	0.45	0.63	0.57	0.68	0.49	0.25	0.77	0.54
TSES Overall										
Min	5.08	5.08	7.17	6.50	5.08	5.08	6.08	5.08	7.08	6.08
Max	8.42	8.00	8.42	8.42	7.83	8.42	8.00	7.17	8.42	8.00
Range	3.33	2.92	1.25	1.92	2.75	3.33	1.92	2.08	1.33	1.92
Mean	7.17	6.92	7.72	7.43	7.01	7.14	7.21	6.67	7.63	7.12
St. Dev	0.79	0.80	0.46	0.72	0.83	0.84	0.77	0.89	0.44	0.83

The examination of Table 4 reveals several findings. First, *Presenters* scored the highest in Student Engagement, Instructional Strategies, and Overall TSES, while *4-6 years teaching* scored highest in Classroom Management. Second, *1-3 years teaching* scored lowest in all categories, while *4-6 years teaching* scored higher than average in all categories. Third, *Non-Presenters* scored lower than average in all categories, while *Presenters* scored more than average in all categories. Fourth, those who study *less than 1 hour* per week have higher self-efficacy than those who study *more than 1 hour* per week.

The Teachers' Attitude Towards Computers (TAC) survey measured overall attitude and on six subscales. The teachers were invited to state their perceptions on the extent to which they agree or disagree with each item. The series of questions were combined into six average sub scores, and combined into an overall average score. The *Interest* subscale measured the teacher's enthusiasm and enjoyment in using technology. The *Comfort* subscale measured their Anxiety towards using technology. The *Interaction e-mail* subscale measured their acceptance toward using the digital tool. The *Concern* subscale measured their thoughts on the impact that technology has on society. The *Utility* subscale measured the usability of classroom technology. And finally, the *Perception* subscale measured their emotions toward using technology. Table 5 shows the descriptive data collected from the online TAC survey and reveals the descriptive data for each of the identified groups.

Table 5

Descriptive Statistics of the Overall and Subscales for the Teachers' Attitude Towards Computers (TAC), by Demographic Grouping

	ALL (*N*=16)	Non-Presenters (*n*=11)	Presenters (*n*=5)	Less than 1hr (*n*=6)	More than 1 hr (*n*=10)	1-3 yrs 1-1 (*n*=10)	4-7 yrs 1-1 (*n*=6)	1-3 yrs teaching (*n*=5)	4-6 yrs teaching (*n*=6)	10+ yrs teaching (*n*=5)
Interest										
Min	2.43	2.43	3.00	2.43	2.57	2.57	2.43	2.57	3.86	2.43
Max	4.43	4.43	4.43	4.43	4.43	4.43	4.43	4.14	4.43	4.43
Range	2.00	2.00	1.43	2.00	1.86	1.86	2.00	1.57	0.57	2.00
Mean	3.67	3.55	3.94	3.57	3.73	3.83	3.40	3.49	4.14	3.29
St. Dev	0.64	0.64	0.59	0.67	0.64	0.56	0.71	0.59	0.24	0.73
Comfort										
Min	5.33	5.33	6.33	6.00	5.33	5.33	6.00	5.33	6.67	6.00
Max	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Range	1.67	1.67	0.67	1.00	1.67	1.67	1.00	1.67	0.33	1.00
Mean	6.52	6.36	6.87	6.50	6.53	6.50	6.56	6.07	6.94	6.47
St. Dev	0.57	0.60	0.30	0.55	0.61	0.63	0.50	0.64	0.14	0.51

(continued)

	ALL (*N*=16)	Non-Presenters (*n*=11)	Presenters (*n*=5)	Less than 1hr (*n*=6)	More than 1 hr (*n*=10)	1-3 yrs 1-1 (*n*=10)	4-7 yrs 1-1 (*n*=6)	1-3 yrs teaching (*n*=5)	4-6 yrs teaching (*n*=6)	10+ yrs teaching (*n*=5)
Interaction e-mail										
Min	2.00	2.25	2.00	3.25	2.00	2.25	2.00	2.25	2.75	2.00
Max	5.00	4.75	5.00	4.00	5.00	5.00	3.75	3.75	5.00	3.75
Range	3.00	2.50	3.00	0.75	3.00	2.75	1.75	1.50	2.25	1.75
Mean	3.53	3.66	3.25	3.50	3.55	3.80	3.08	3.25	4.08	3.15
St. Dev	0.83	0.70	1.10	0.32	1.05	0.85	0.63	0.59	0.92	0.68
Concern										
Min	4.20	4.20	5.40	5.20	4.20	4.20	5.20	4.20	5.20	5.20
Max	6.40	6.40	6.40	6.20	6.40	6.40	6.40	6.00	6.40	6.40
Range	2.20	2.20	1.00	1.00	2.20	2.20	1.20	1.80	1.20	1.20
Mean	5.65	5.55	5.88	5.83	5.54	5.60	5.73	5.24	5.90	5.76
St. Dev	0.63	0.69	0.41	0.43	0.72	0.74	0.43	0.82	0.45	0.48
Utility										
Min	4.00	4.00	4.25	4.00	4.00	4.00	4.00	4.00	4.25	4.00
Max	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.75
Range	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	0.75	0.75
Mean	4.59	4.52	4.75	4.58	4.60	4.60	4.58	4.60	4.67	4.50
St. Dev	0.41	0.44	0.31	0.47	0.39	0.44	0.38	0.55	0.38	0.35
Perception										
Min	3.50	3.50	4.75	4.75	3.50	3.50	4.75	3.50	5.00	4.75
Max	7.00	7.00	7.00	7.00	7.00	7.00	6.75	7.00	7.00	6.75
Range	3.50	3.50	2.25	2.25	3.50	3.50	2.00	3.50	2.00	2.00
Mean	5.83	5.75	6.00	5.79	5.85	5.90	5.71	5.55	6.29	5.55
St. Dev	1.00	1.02	1.05	0.86	1.12	1.12	0.84	1.37	0.71	0.84
TAC Overall										
Min	3.15	3.22	3.15	3.26	3.15	3.22	3.15	3.22	3.30	3.15
Max	4.07	4.04	4.07	3.89	4.07	4.07	3.85	3.85	4.07	3.85
Range	0.93	0.81	0.93	0.63	0.93	0.85	0.70	0.63	0.78	0.70
Mean	3.62	3.62	3.61	3.55	3.66	3.72	3.44	3.61	3.81	3.39
St. Dev	0.31	0.29	0.39	0.28	0.33	0.29	0.27	0.26	0.28	0.27

The examination of Table 5 reveals many findings. First, *4-6 years teaching* is always above average, while *1-3 years teaching* is below average for every category except Utility. Second, lowest scores ranged from *10+ years teaching* (Interest, Utility, Perception, Overall), to *1-3 years teaching* (Comfort, Concern, Perceptions) to *4-7 years teaching 1-to-1* (Interaction e-mail) while the highest scores are with the *4-6 years teaching* (except Utility which goes to the *Presenters*). Third, less than *1 hour learning* per week always scores lower compared to *more than 1 hour learning* per week (except

in the Concern category, where the trend is reversed). Fourth, *1-3 years teaching 1-to-1* is always opposite from *4-6 years teaching 1-to-1* compared to the average (if one is higher than average, the other is always below average). Fifth, Presenters are always the highest, with the exception of the email category.

The Teachers' Attitude Towards Information Technology (TAT) survey measured overall attitude and on five subscales. The teachers were invited to state their perceptions on a scale with positive adjectives on one end, and negative adjectives on the other end. A series of three questions for each subscale were combined into 5 averages, and an overall average score. Table 6 shows the descriptive data collected from the online TAT survey, and reveals the descriptive data for each of the groups.

Table 6

Descriptive Statistics of the Overall and Subscales for the Teachers' Attitude Towards Information Technology (TAT), by Demographic Grouping

	ALL (*N*=16)	Non-Presenters (*n*=11)	Presenters (*n*=5)	Less than 1hr (*n*=6)	More than 1 hr (*n*=10)	1-3 yrs 1-1 (*n*=10)	4-7 yrs 1-1 (*n*=6)	1-3 yrs teaching (*n*=5)	4-6 yrs teaching (*n*=6)	10+ yrs teaching (*n*=5)
E-mail										
Min	1.00	1.00	2.00	3.33	1.00	1.00	2.00	1.00	2.00	3.00
Max	7.00	6.33	7.00	6.33	7.00	7.00	4.00	6.33	7.00	4.00
Range	6.00	5.33	5.00	3.00	6.00	6.00	2.00	5.33	5.00	1.00
Mean	4.10	4.12	4.07	4.50	3.87	4.67	3.17	4.53	4.33	3.40
St. Dev	1.51	1.38	1.96	1.17	1.70	1.63	0.66	2.05	1.63	0.37
WWW										
Min	4.00	4.00	6.00	6.00	4.00	4.00	5.00	6.00	4.00	5.00
Max	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	6.67
Range	3.00	3.00	1.00	1.00	3.00	3.00	2.00	1.00	3.00	1.67
Mean	6.25	6.15	6.47	6.44	6.13	6.30	6.17	6.53	6.22	6.00
St. Dev	0.82	0.94	0.51	0.40	1.00	0.92	0.69	0.51	1.17	0.62
Multimedia										
Min	4.33	4.33	5.67	4.67	4.33	4.33	4.67	4.33	5.67	4.67
Max	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Range	2.67	2.67	1.33	2.33	2.67	2.67	2.33	2.67	1.33	2.33
Mean	6.23	6.03	6.67	6.06	6.33	6.33	6.06	6.13	6.61	5.87
St. Dev	0.91	0.98	0.58	0.88	0.96	0.87	1.02	1.10	0.61	1.02

(continued)

	ALL (*N*=16)	Non-Presenters (*n*=11)	Presenters (*n*=5)	Less than 1hr (*n*=6)	More than 1 hr (*n*=10)	1-3 yrs 1-1 (*n*=10)	4-7 yrs 1-1 (*n*=6)	1-3 yrs teaching (*n*=5)	4-6 yrs teaching (*n*=6)	10+ yrs teaching (*n*=5)
Teacher Productivity										
Min	2.67	2.67	5.33	4.00	2.67	2.67	4.00	2.67	5.00	4.00
Max	7.00	7.00	7.00	7.00	7.00	7.00	6.67	7.00	7.00	6.67
Range	4.33	4.33	1.67	3.00	4.33	4.33	2.67	4.33	2.00	2.67
Mean	5.90	5.73	6.27	5.94	5.87	6.03	5.67	5.60	6.39	5.60
St. Dev	1.25	1.44	0.64	1.14	1.36	1.40	1.01	1.79	0.80	1.12
Student Productivity										
Min	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00
Max	7.00	7.00	7.00	6.67	7.00	7.00	6.33	6.67	7.00	6.33
Range	3.00	3.00	3.00	2.67	3.00	3.00	2.33	2.67	2.00	2.33
Mean	5.54	5.52	5.60	5.44	5.60	5.87	5.00	5.67	5.94	4.93
St. Dev	1.05	1.06	1.14	0.91	1.16	1.01	0.94	1.15	0.88	1.04
TAT Overall										
Min	4.00	4.00	5.12	4.67	4.00	4.00	4.67	4.00	5.00	4.67
Max	7.00	6.80	7.00	6.80	7.00	7.00	5.80	6.80	7.00	5.80
Range	3.00	2.80	1.88	2.13	3.00	3.00	1.13	2.80	2.00	1.13
Mean	5.60	5.51	5.81	5.68	5.56	5.84	5.21	5.69	5.90	5.16
St. Dev	0.81	0.87	0.71	0.73	0.89	0.92	0.39	1.13	0.71	0.41

The examination of Table 6 reveals several findings. First, *4-6 years teaching* scored highest in both teacher productivity and student productivity, while *10+ years teaching* scored lowest in each category. Second, *10+ years teaching* scored lowest in 4 out of 5 categories, while *Presenters* scored highest in all categories except email. Third, *1-3 years teaching* scored highest in WWW category, while *Presenter* scored highest in the Multimedia category. Fourth, the Standard Deviation scores on this survey appear to be higher in general that on other surveys.

This section looked at descriptive statistics for each of the identified subgroups and identified some of the findings compared to the overall scores. The following section will be a correlation study, exploring the linear relationships between various factors as measured by the survey instruments.

What is the Relationship Among Self-Reported Teacher Self Efficacy and Teachers' Attitude Towards Instructional Technology?

The Pearson product-moment correlation examines the linear relations ship between two variables and identifies a correlation coefficient that indicates the strength of the relationship. The Pearson correlation coefficient can range in value from +1 to -1. A value of 0 indicates that there is no association between the two variable. A positive value indicates a positive association (as one-factor increases so does the factor), while a negative value indicates a negative association (as one factor increase the other factor decreases). Table 2 was used in this study to interpret the Pearson correlations.

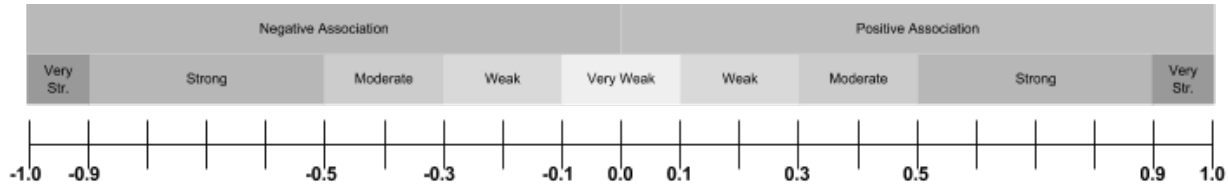

Figure 2. Correlational relationships. This figure illustrates the Pearson correlation measures used in this study.

To explore this question, the study employed Pearson correlations to examine the relationships among teachers' scores on the three measures: teacher self-efficacy, as measured by the TSES survey (overall TSET, E1, E2 and E3); and teacher attitudes towards instructional technology, as measured by the TAC survey (overall TAC, A1, A2, A3, A4, A5 and A6) and TAT survey (overall TAT, A7, A8, A9, A10, and A11). Table 7 describes the Pearson-r correlations that were found for the sample (N=16).

Table 7

Pearson Correlations Among TSES, TAC and TAT

Variable	TSES	E1	E2	E3	TAC	A1	A2	A3	A4	A5	A6	TAT	A7	A8	A9	A10	A11
TSES Overall	1.00 .00	0.83 .00	0.91 .00	0.60 .01	0.16	0.15	0.45	0.23	0.43	0.27	0.40	0.42	0.34	0.21	0.07	0.50 .04	0.31
E1 Student Engagement		1.00 .00	0.61 .01	0.28	0.26	0.09	0.34	0.46	0.35	0.15	0.41	0.53 .04	0.54 .03	0.26	(0.12)	0.57 .02	0.49
E2 Instructional Strategies			1.00 .00	0.41	0.05	0.07	0.44	0.03	0.41	0.31	0.37	0.35	0.21	0.30	0.15	0.43	0.20
E3 Classroom Management				1.00 .00	0.12	0.28	0.26	0.08	0.22	0.16	0.10	0.01	(0.01)	(0.26)	0.15	0.10	0.00
TAC Overall					1.00 .00	0.78 .00	0.55 .03	0.71 .00	0.23	0.50 .05	0.85 .00	0.76 .00	0.49	0.25	0.54 .03	0.63 .01	0.82 .00
A1 TAC Interest						1.00 .00	0.68 .00	0.38	0.47	0.57 .02	0.64 .01	0.59 .02	0.23	0.13	0.73 .00	0.55 .03	0.56 .023
A2 TAC Comfort							1.00 .00	0.40 .13	0.62 .01	0.57 .02	0.75 .00	0.60 .01	0.34	0.05	0.44	0.79 .00	0.49
A3 TAC Email								1.00 .00	0.30	0.06	0.60 .01	0.51 .04	0.59 .02	(0.09)	(0.03)	0.46	0.67 .01
A4 TAC Concern									1.00 .00	0.62 .01	0.51 .05	0.42	0.31	(0.02)	0.17	0.59 .02	0.34
A5 TAC Utility										1.00 .00	0.69 .00	0.64 .01	0.34	0.31	0.57 .02	0.68 .00	0.43
A6 TAC Perception											1.00 .00	0.84 .00	0.52 .04	0.33	0.43	0.86 .00	0.83 .00
TAT Overall												1.00 .00	0.77 .00	0.58 .02	0.49	0.87 .00	0.85 .00
A7 TAT Email													1.00 .00	0.20	(0.01)	0.63 .01	0.62 .01
A8 TAT WWW														1.00 .00	0.43	0.35	0.36
A9 TAT Multimedia															1.00 .00	0.31	0.32
A10 TAT Teacher Productivity																1.00 .00	0.69 .00
A11 TAT Student Productivity																	1.00 .00

Note. N = 16

Key

1.00 (*Pearson-r Correlation*)
.00 (*p-value* if <0.05)

Table 7 reveals that there are many positive correlations and a few negative correlations between many of the overall scores and subscales for each survey instrument. There are 52 relations that are identified as statistically significant (p-Value < 0.05). Of these, only one (1) very strong positive relationship was identified with a 0.91 correlation between TSES overall and E2 – Instructional Strategies. There are fifty (50) strong positive relationships, with the strongest with a 0.87 correlation between TAT overall score and A10 – TAT Teacher Productivity. This is followed by closely at 0.86 correlation between A6 – TAC Perception and TAT Overall. Additionally, there is one (1) moderate correlation (0.40) between TAC-Comfort and TAC-Email. The remaining associations fall within the weak or very weak categories and are not statistical significant.

Correlations Data About Survey Measures, by Demographic Grouping

To better understand the correlations, the groupings that were identified in the sample data (Years Teaching, Years Teaching 1-to-1, Hours Spent Learning New Technology Skills, and Conference Presenting) were used to run additional Pearson-r correlations. This section of the study explores those findings.

One of the groupings that were identified in the sample data was that of presenters at professional development conferences. Five participants were identified as presenters, and eleven were identified as non-presenters. Table 8 describes the correlation data for non-presenters and presenters.

Table 8

Pearson Correlations Among Non-Presenters/Presenters

Non-presenters ***n*=11**	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	0.38	(0.09)	0.20	0.64	0.17	0.15	0.56
TSES-Instructional Practice	0.38	0.08	0.39	0.57	0.47	0.32	0.69
TSES-Classroom Management	0.45	0.40	0.25	0.44	0.25	0.30	0.31
TSES-Overall	0.49	0.12	0.36	0.70	0.39	0.32	0.69
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.58	0.49	0.24	(0.25)	0.56	0.58	
TSES-Instructional Practice	0.53	0.55	0.28	0.01	0.54	0.53	
TSES-Classroom Management	0.14	0.12	(0.23)	0.23	0.12	0.14	
TSES-Overall	0.56	0.53	0.18	(0.03)	0.55	0.56	
Presenters ***n*=5**	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	0.08	0.20	0.29	0.67	0.88	(0.39)	(0.10)
TSES-Instructional Practice	(0.80)	(0.75)	(0.41)	(0.66)	(0.43)	(0.34)	(0.75)
TSES-Classroom Management	(0.75)	(0.40)	(0.12)	(0.59)	(0.21)	(0.90)	(0.72)
TSES-Overall	(0.72)	(0.50)	(0.14)	(0.24)	0.15	(0.74)	(0.78)
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.63	0.90	0.04	(0.51)	0.48	0.36	
TSES-Instructional Practice	(0.69)	(0.44)	0.01	(0.24)	(0.78)	(0.83)	
TSES-Classroom Management	(0.68)	(0.34)	(0.83)	(0.79)	(0.39)	(0.54)	
TSES-Overall	(0.32)	0.11	(0.24)	(0.70)	(0.36)	(0.51)	

Table 8 indicates that there many positive and negative correlations among presenters and non-presenters. First, there is only one (1) very strong positive correlation for Presenters (0.90) between TSET-Student Engagement and TAT-Email which is equally in weight to the one (1) very strong negative correlation for Presenters (-0.9) between TSES-Classroom Management and TAC-Utility. Second, Non-Presenters generally show positive correlations between the TSES and TAC/TAT while Presenters generally show negative relationships. Third, the generalities previously listed do have one notable exception, the correlation between Presenters TSES-Student

engagement and various TAC/TAT factors are positive associations while the other TSES factors have week to strong negative correlations.

Another grouping that was identified in the sample data was how many hours participants spent learning new technology skills to be used in the classroom. Six participants stated that they spend less than 1 hour learning new skills, while ten reported that they spent more than 1 hour learning new skills each week. Table 9 describes the correlation data for the two different rates for learning new technology skills.

Table 9

Pearson Correlations Among Hours Learning per Week

Less than 1 hour learning per week *n*=6	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	(0.35)	(0.12)	0.28	0.28	0.82	(0.10)	(0.02)
TSES-Instructional Practice	(0.72)	(0.41)	0.12	0.00	0.45	(0.58)	(0.38)
TSES-Classroom Management	0.37	0.67	0.72	0.56	0.78	0.38	0.30
TSES-Overall	(0.33)	(0.01)	0.40	0.31	0.81	(0.14)	(0.06)
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.06	(0.02)	(0.04)	(0.50)	0.38	0.28	
TSES-Instructional Practice	(0.28)	(0.19)	(0.29)	(0.70)	0.05	(0.01)	
TSES-Classroom Management	0.32	0.09	(0.20)	0.33	0.71	0.03	
TSES-Overall	0.03	(0.05)	(0.18)	(0.41)	0.39	0.15	
More than 1 hour learning per week *n*=10	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	0.61	0.24	0.37	0.58	0.20	0.34	0.64
TSES-Instructional Practice	0.30	0.28	0.58	0.05	0.35	0.66	0.57
TSES-Classroom Management	0.12	0.14	0.06	0.02	(0.07)	0.02	0.04
TSES-Overall	0.45	0.30	0.51	0.26	0.27	0.54	0.60
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.79	0.83	0.37	0.10	0.68	0.62	
TSES-Instructional Practice	0.50	0.22	0.32	0.45	0.57	0.29	
TSES-Classroom Management	(0.19)	(0.17)	(0.43)	0.15	(0.23)	0.02	
TSES-Overall	0.57	0.42	0.24	0.35	0.55	0.42	

The researcher wanted to understand the relationship between self-learning and self-efficacy. Table 9 shows some interesting findings of these two demographic groups. Those who spend less than 1 hour per week learning new technology skills were found to have many moderate to strong negative correlations between the TSES and TAC/TAT survey instruments. For the TAC, 6 negative correlations were identified and occurred in majority occurred in the TAC Overall or TSES-instructional Practices categories. In comparison, those who spend more than 1 hour learning new technology skills per week had positive correlations for nearly all TSES/TAC comparisons and had a strong positive correlation between TSES-Student Engagement and TAT-Overall and TAT-Email (0.79 and 0.83, respectively).

The teachers at Minarets may spend a variety of hours learning new technology skills, but they also range from interns to veteran teachers. An additional group that was identified in the sample was the number of years teaching. The responses ranged from 1st year teachers to over 20 years. Three groups were identified in the sample data (1-3 years, 4-6 years and over 10 years). Table 10 describes the correlation data for these three groups

Table 10

Pearson Correlations Among Years Teaching

1-3 years teaching *n*=5	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	0.57	(0.13)	0.26	0.93	0.09	0.20	0.52
TSES-Instructional Practice	0.94	0.43	0.78	0.87	0.62	0.79	0.94
TSES-Classroom Management	0.39	0.00	0.52	0.43	0.24	0.46	0.50
TSES-Overall	0.84	0.20	0.62	0.96	0.44	0.60	0.83
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.52	0.75	0.22	(0.43)	0.67	0.49	
TSES-Instructional Practice	0.94	0.95	0.78	0.16	0.98	0.93	
TSES-Classroom Management	0.49	0.65	0.33	(0.08)	0.47	0.43	
TSES-Overall	0.83	0.95	0.59	(0.10)	0.92	0.81	
4-6 years teaching *n*=6	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	(0.24)	0.09	0.44	0.14	0.58	(0.19)	(0.24)
TSES-Instructional Practice	(0.83)	(0.60)	0.39	(0.92)	0.10	0.01	(0.55)
TSES-Classroom Management	(0.45)	(0.16)	(0.42)	(0.24)	0.35	(0.01)	(0.58)
TSES-Overall	(0.91)	(0.43)	0.23	(0.66)	0.57	(0.10)	(0.81)
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.62	0.83	0.30	(0.25)	0.46	0.31	
TSES-Instructional Practice	(0.30)	(0.34)	0.24	(0.30)	(0.14)	(0.57)	
TSES-Classroom Management	(0.70)	(0.23)	(0.67)	(0.52)	(0.42)	(0.78)	
TSES-Overall	(0.27)	(0.09)	(0.08)	(0.62)	(0.09)	(0.65)	
10+ years teaching *n*=5	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	(0.13)	(0.38)	(0.15)	0.02	0.29	0.21	0.32
TSES-Instructional Practice	(0.42)	(0.50)	(0.70)	(0.46)	(0.52)	(0.22)	(0.38)
TSES-Classroom Management	0.21	0.14	(0.18)	(0.45)	(0.43)	0.16	0.17
TSES-Overall	(0.22)	(0.37)	(0.44)	(0.32)	(0.23)	0.02	(0.02)
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.45	(0.35)	0.64	(0.18)	0.26	0.53	
TSES-Instructional Practice	(0.05)	(0.88)	0.93	0.26	(0.48)	(0.09)	
TSES-Classroom Management	0.56	(0.86)	0.80	0.58	(0.03)	0.38	
TSES-Overall	0.29	(0.77)	0.90	0.18	(0.13)	0.26	

Table 10 reveals some of the many differences between beginning and experienced teachers. There are ten (10) very strong positive correlations between

various factors for teachers with 1-3 years teaching experience and six (6) of these very strong correlations are related to their TSES-Instructional Practices. Additionally, these teachers indicate many moderate to strong associations for many other factors. Those teachers who have been teaching 4-6 years have many moderate to strong negative correlations between TSES and TAC/TAT, and even have two very strong negative correlations (TSES-Overall / TAC-Overall and TSES-Instructional Practices / TAC-Email at -.0.91 and -0.92, respectively). The experienced teachers who have been teaching for 10 or more years have a variety of moderate to strong correlations (both positive and negative) and have two very strong positive correlations TAT-WWW and both TSES-Instructional Practices (0.93) and TSES Overall (0.90).

Minarets High School is a 1-to-1 technology school that has been open for seven years, so the survey also asked teachers for how many years they have been teaching in that environment. The participant's indicated from 1st year to have been teaching for six years. Teachers were group into 1-3 years teaching 1-to-1 or 4-6 years teaching 1-to-1. Table 11 describes the correlation data for years teaching 1-to-1.

Table 11

Pearson Correlations Among Year Teaching 1-to-1

1-3 years teaching 1-to-1 *n*=10	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	0.33	0.25	0.53	0.59	0.41	0.12	0.44
TSES-Instructional Practice	0.38	0.48	0.78	0.46	0.68	0.44	0.62
TSES-Classroom Management	(0.04)	0.27	0.40	0.13	0.41	0.13	0.05
TSES-Overall	0.33	0.43	0.74	0.52	0.64	0.32	0.52
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.54	0.71	0.14	(0.17)	0.66	0.43	
TSES-Instructional Practice	0.67	0.71	0.12	0.10	0.82	0.56	
TSES-Classroom Management	(0.19)	(0.06)	(0.59)	(0.09)	0.09	(0.28)	
TSES-Overall	0.52	0.65	(0.04)	(0.05)	0.73	0.40	

(continued)

4-7 years teaching 1-to-1 *n*=6	TAC Overall	TAC Interest	TAC Comfort	TAC Email	TAC Concern	TAC Utility	TAC Perception
TSES-Student Engagement	(0.09)	(0.32)	(0.11)	0.00	0.27	0.21	0.31
TSES-Instructional Practice	(0.13)	(0.23)	(0.37)	(0.52)	(0.53)	(0.07)	(0.10)
TSES-Classroom Management	0.26	0.19	(0.09)	(0.47)	(0.44)	0.23	0.22
TSES-Overall	(0.05)	(0.21)	(0.26)	(0.37)	(0.26)	0.17	0.12
	TAT Overall	TAT Email	TAT WWW	TAT Multimedia	TAT Tch Prod	TAT Stu Prod	
TSES-Student Engagement	0.45	(0.23)	0.56	(0.13)	0.27	0.53	
TSES-Instructional Practice	0.10	(0.77)	0.94	0.41	(0.35)	0.00	
TSES-Classroom Management	0.58	(0.57)	0.74	0.59	0.00	0.40	
TSES-Overall	0.36	(0.62)	0.87	0.28	(0.78)	0.30	

Table 11 shows that there are many positive correlations with the teachers who have only been teaching for 1-3 years in a 1-to-1 program, and that the TAC correlations specifically get much weaker for those teachers who have taught for 4-7 years in a 1-to-1 program. The strongest correlations for teachers with 1-3 years' experience teaching 1-to-1 are in the TAC-Comfort category (0.53 for Student Engagement, 0.78 for Instructional Practice, 0.40 for Classroom Management and 0.75 Overall). In comparison, those teachers with 4-7 years' experience teaching 1-to-1 have the highest correlations in the TAT-WWW category (0.56 for Student Engagement, 0.94 for Instructional Practice, 0.74 for Classroom Management and 0.87 Overall).

What is the Relationship Among Self-Reported Teacher Self Efficacy and Student Productivity?

This research question seeks to understand the differences in Teacher Self Efficacy and student productivity in relationship to the various demographic groups. Table 12 pulls together the four TSES categories (Student Engagement, Instructional Practice, Classroom Management and Overall TSES) with the TAC-Student Productivity

factor. The table shows the correlation value between the TSES factors and TAC-Student Productivity for each of the demographic groups previously discussed.

Table 12

Pearson Correlations for TSES-Student Productivity, Demographic Groups

	All (*N*=16)	Non-presenters (*n*=11)	Presenters (*n*=5)	Less than 1 hr (*n*=6)	More than 1 hr (*n*=10)	1-3 yrs 1-to-1 (*n*=10)	4-7 yrs 1-to-1 (*n*=6)	1-3 yrs (*n*=5)	4-6 yrs (*n*=6)	10+ yrs (*n*=5)
TSES-Student Engagement	0.49	0.58	0.36	0.28	0.62	0.43	0.53	0.49	0.31	0.53
TSES-Instructional Practice	0.20	0.53	(0.83)	(0.01)	0.29	0.56	0.00	0.93	(0.57)	(0.09)
TSES-Classroom Management	(0.00)	0.14	(0.54)	0.03	0.02	(0.28)	0.40	0.43	(0.78)	0.38
TSES-Overall	0.31	0.56	(0.51)	0.15	0.42	0.40	0.30	0.81	(0.65)	0.26

Table 12 reveals many levels of student productivity correlations that exist for each of the demographic groups and the TSES scale. First, A very strong positive correlation (0.9) is found to be in the Instructional Practices of teachers who have been teaching 1-3 years. While this is the strongest correlation for this group, they have a moderate to strong correlational relationships with each of the other TSES categories. Second, Non-Presenters have a strong positive correlation with ¾ of the TSES factors compared to Presenters who have a strong negative correlation with ¾ of the TSES factors. Non-Presenters show the weakest correlation with the Classroom Management factor (0.14), while Presenters show the weakest correlation with the Student Engagement factor (0.38). Third, Teachers who have been teaching 4-6 years have similarities to the Presenters, each has a moderate association to Student Engagement, and strong

negative associations to Instructional Practices, Classroom Management and their overall TSES scores.

Though student productivity was measured using the TAT survey instrument, the research acknowledges that there are many more ways to show student productivity. To list a few, some of the accomplishments student have achieved are: Seven Slick Rock awards including Best in Show in 2016 and Best Media Program in 2016, Three FFA National Championships, two in parliamentary procedure and one in livestock judging, 11 state championships in FFA, three-time winner of Apple Distinguished School award and Minarets students were the highest performing school in Madera County on the state CAASPP tests in 2016. Additionally, seven students have presented at the Apple headquarters in Cupertino. These accomplishments help to recognize the accomplishments that all Minarets students can achieve. Minarets is a Project-based School so the students engage in many activities that cannot be directly correlated to teacher self-efficacy. For this student, student productivity correlations have been limited to the data collected though the survey instruments.

What are the School/District Factors that Promote the Use of Technology in the Classroom by and for Students?

In order to better understand the specific district and school factors that promote the use of technology at Minarets High School and Minarets International Charter High School, the researcher interviewed teachers and administrators of the school campus. Each of these participants volunteered to be interviewed in person, and also completed the questionnaires. In all, the researcher completed nine interviews on a follow-up day after the staff meeting that was used to complete the questionnaires. The interview

consisted of ten (10) questions, two of which were coded for descriptive statistic use (see Table 2 for demographic information). The following section provides a summary of these interviews and subsequent coding for the remaining eight (8) questions.

Strategies for advancing technology skills. The Minarets High School teachers, administrators, and staff utilize their own classroom technology on a daily basis and ask their students to complete assignments and projects on a daily, weekly, and monthly basis. To understand how the participants advanced their personal technology skills that they use for the benefit of their students, the participants were asked, *"What are your strategies for advancing your skills in using technology?"* The answers for each participant varied, and each often used a combination of learning methods. Table J1 shows the coding used for the *Methods for Learning* element and provides a look into the learning methods used at Minarets.

These examples show some of that learning is personalized and comes from the individual's need to learn new skills. Whether it is for "personal research" or school use, the participants show that learning derives from their own desire to learn, and that they each learn through a variety of methods including "a lot of … just trial and error." Participants range from learning on their own through research and conferences, to learning with students and their entire professional learning networks. These teachers use what fits with their own style of learning and their own connectivity with other experts, and then share these news skills with their school and students.

Sharing technology skills with others. As mentioned earlier, the researcher had prior knowledge about the school district's and the school's support of teachers attending and presenting at local and regional conferences. To better understand how

the staff at Minarets shares what they have learned with staff and students, participants were asked, *"After learning something new, how do you share what you have learned with others?"* Table J2 reveals the coding used for the *Methods for Sharing* element and provides a look into how teachers share new skills.

The interviews indicate that the participants teach others with intentionality by going through "a step-by-step process," or that when they learn new technology skills or tools, they look at how they might be applied by colleagues and students. Sharing happens on a one-to-one basis, but is also recorded for extended use in the "Minarets Playbook," "walk-though tutorial video," or "concise visual learning steps [pdf]." These examples show that the staff at Minarets shares their technology knowledge in a variety of ways and mirrors their own views on instructional technology.

Feelings about instructional technology. The participants have revealed many of their attitudes towards technology through the questionnaires, but the researcher wanted to go deeper than that instrument would allow. To enhance the research, participants were asked, *"What is your gut feeling about instructional technology?"* This question probed deeply and through the coding process revealed six elements. Table J3 show the coding used to develop the six elements found when taking a personal look at instructional technology at Minarets.

The intensity with which participants answered this question shows how deeply they feel about the proper integration of technology at Minarets High School and Minarets International Charter High School. The participants see the value of students using technology and how that knowledge is going to benefit them in the future. One interviewee stated that "if we don't expose them [students] to that in some way then

we're putting them at a disadvantage in the future." The interview question also revealed the purpose of the teacher in a student-centered and project-based curriculum that shifts instructional methods from more traditional direct instruction methods to one focused on innovation and creative solutions. Teachers have to be an "effective communicator," committed to the integration of technology and expect their students to "open up all kinds of doors" by advancing their own skillsets throughout their tenure at Minarets.

Student use of technology in the classroom. Student use of technology appears to vary by teacher, grade level, subject, and the projects that students are creating. To understand a little more about student use of technology, participants were asked, *"Please explain what students do with technology in your classes."* Compared to their prior responses about their feeling towards technology, the responses for this question were minimal. Table J4 indicated the codes that were collected during this portion of the interview, and the subsequent elements that were identified.

The student use of technology seemed difficult for the teachers/administrators to quantify. With the ever-changing demands that they place on their students through the focus on project-based learning, the applications, tools, and skills required vary dramatically by class and even by the student's choice of project. For example, "with technology, really you can just say, 'I want you to know about this'" which allows a student to "do the research" and then take that information and present their finding to the other students. The district's commitment to Minarets and PBL plays a key role in providing student access to the technology and tools that are needed for basic and

complex projects that allow students to “stay [on the] cutting edge, not only to use technology, but to be relevant in the industry.”

District influence on the use of technology. Since the researcher previously worked for Chawanakee Unified School District, there was existing knowledge about the creation of Minarets High School and the subsequent opening of Minarets International Charter High School. The researcher worked for the district’s elementary schools that feed into Minarets and knew of the district support and influence at those schools. To better understand the impact the district office has had on Minarets specifically, the participants were asked, *“In what ways has the district influenced the use of technology at Minarets?”* Table J5 shows the results of the coding used to identify the elements found when looking at the various ways the district has influenced the integration of technology at Minarets.

The participants revealed the benefits that a supportive Superintendent and School Board can provide to a school that is choosing to integrate technology into their curriculum. For example, “They’ve done nothing but support the direction in which Minarets as a staff and administration wants to go.” This support comes not only from the district, but is also supported by the community at large. Combined they provide fiscal support necessary to provide the technology and materials/equipment for a project based learning high school. These financial resources also are used to train and prepare teachers to use the equipment, and to guide the learning of students through its use. The 24/7 access to professional quality equipment is a major change from the laptop carts era of the past. The district and community are not the only supporters. The administration and staff at Minarets also play a key role.

School influence on the use of technology. The leadership and staff of a school are the ones who direct the learning and, in this case, the adoption and use of technology by teachers and students. The participants were asked, "*In what ways has Minarets High supported the use of technology at Minarets?"* to learn about how school factors influence technology use. Table J6 shows the coding and the elements that were identified through this question.

The coding of this question showed the participants' appreciation for the students access to technology, the focus on project based learning ("the push is for everything to be large projects"), and the support that the administration has for the expert teachers. Without any one of these factors, the school would not be where it is today. "We're not bringing poster boards and foils, we're doing projects through the technology" showcases the difference when integrating technology with PBL. Each of these categories (Hardware/Software, Project based, and Leadership) are required to have a Project Based curriculum that focuses specifically on the integration of technology. All of the categories identified so far lead the researcher to identify any additional differences between Minarets and other more traditional high schools.

Difference from other schools. The researcher used the question "*What makes Minarets different from other schools?"* to understand the participants' views of Minarets compared to other schools. The interviewees ranged from those who had only worked at Minarets, to those who had spent most of their time at other schools. Table J7 shows the findings of this interview question and the subsequent elements that were identified.

The creation of Minarets as a Project-Based 1-to-1 technology integrated high school appears to have provided an environment that has created a different culture from most other high schools. The focus on students learning about their interests and the ability to apply projects across the curriculum allows for deeper learning. One interviewee expressed it this way, "We kind of allow students to be themselves and pursue what they want to pursue…we try to find that engagement that other schools don't really care about." The difference starts with the leadership and choice to use PBL and technology to enrich the learning space. These create a unique atmosphere that promotes a school wide culture of excellence focused "on developing kids holistically as a whole person." This atmosphere is further enhanced by the relationships between administrators, teachers, and students on a campus where "asking students what they are interested in and asking student how they are doing" is the norm. The next question is, can this type of learning environment be duplicated into other districts who are looking at developing a similar model.

Duplicating the culture into existing or new schools. In order to understand if the learning environment that exists at Minarets can be started at other school sites, participants were asked, "*In your opinion, can this environment be duplicated into existing or new schools?"* This question again prompted many in depth responses, the codes, and identified elements are shown in Table J8.

Through the interviews with the staff at Minarets, one can see that they believe that there is a culture at Minarets that exists and can be duplicated in part. They identified many requirements that are necessary, such as "rigor, relevance, and relationships," and some are not within the control of the school (i.e. Fitting the needs of

the community, full on support by the district, to name a few). There are parts that can definitely be taken to new or existing schools, such as the model of Project-Based Learning and 1-to-1 student-to-technology ratio. Schools can go even further and provide 24/7 access to students as Minarets does. There are many leadership requirements and teacher requirements that can lead to successfully building a school culture similar to Minarets but to be really effective, the district and school must have an all-in mentality where this "student culture of being here!" can be established.

These interviews revealed the complexity of the culture that has been developed at Minarets, and what is required to maintain, grow and share this culture. What Chawanakee Unified has created is truly one of a kind. Minarets is the only public and charter high school to share the same site, courses, and faculty and is also a pioneer in implementing technology into a full project-based curriculum. There are many things to learn still as this school continues to develop, but a foundation has been set that any school can use to build their own program.

Limitations

There are limitations to this research. The first limitation is that all of the participant data was self-reported. The results are limited by the accuracy with which each participant answered each question. Self-reported data can be subject to bias that can affect the validity of the findings. Though nine (9) of the participants were interviewed, the basis of these interviews was not to validate the survey findings, but instead, they were used to look into other aspects of the case.

The second limitation of the study is that only four (4) demographic characteristics were included in this study (Years Teaching, Years Teaching 1-to-1,

Hours Spent Learning New Technology Skills, and Presents at Conferences). The participants may differ in other demographic characteristics that are not included in this study, and these additional characteristics may have an impact on the results.

A third limitation is the size of the study. With only 16 survey participants (73% of the school's staff), the study has limited ability to generalize the findings. Additionally, the correlation research design makes it impossible to generalize the findings outside of the case. The research, however, may have implications for other populations with similar goals of Project-Based Learning in a 1-to-1 technology integrated school.

Summary

Analysis of the survey data revealed a variety of descriptive statistics and correlations around teacher self-efficacy and teacher attitude toward instructional technology. The descriptive data reveal knowledge about the measured factors (see page 51) of the sample population at Minarets High School, while the correlation data reveal the relationships between those factors. Even though the sample sizes are small due to the size of the school (only 21 possible teachers/administrators within Minarets High School and Minarets International Charter High School), many strong and very strong correlations could be identified when using the entire sample of 16 survey participants. The sub-group demographic data, though represented in this paper, does not have statistical significance do to the limited sample size.

Analysis of the interview data was used to find out what district/school factors, if any, promote the use of technology in the classroom by and for students? The interviews with 9 of the Minarets staff revealed 27 elements that are part of the schools' overall framework of tech integration. These 27 elements will be explored further in

Chapter 5 as the researcher maps out this technology integration framework revealed through the interview process.

The importance of the findings in this chapter is discussed in chapter 5. Additionally, implications for other schools looking to integrate technology into their curriculum and implications for future research are presented.

Chapter Five: Conclusions and Suggestions for Further Research

Modern technology has been in the classroom since the early 1900s, and the literature review revealed that integration of any new technology is a significant challenge for educators. Yet there are pockets of success where technology has been integrated into successful schools. Minarets High School and Minarets International Charter High School is one of those schools. This case study used the staff at Minarets to explore the following research questions:

1. What teacher and district/school factors allow for effective technology integration? Specifically,
    a. What relationship, if any, exists between teachers' sense of self-efficacy and teachers' attitudes toward instructional technology?
    b. What relationship, if any, exists among the factors of teachers' sense of self-efficacy (Student Engagement, Instructional Practice, and Classroom Management) and Student Productivity?
    c. What district/school factors, if any, promote the use of technology in the classroom by and for students?

Summary and Discussion

Based on the literature review on the topic of teacher self-efficacy and attitudes toward technology, research was conducted using questionnaires to quantify the existence and extent of any relationships between teachers' self-efficacy and attitudes, while follow-up interviews were used to identify various school and district factors that promote the use of technology in the classroom. Chapter 4 shares many of the findings

from this research. The following provides a look at the results for each of the research questions.

Teachers' self-efficacy. The review of the literature found that self-efficacy can be a predictor of success based on past experiences. The findings of this study have revealed the high levels of teacher self-efficacy that can be found at Minarets High School. Those who self-identified themselves as presenters had the highest levels of self-efficacy, followed closely by those who spend less than 1 hour per week learning new technology skills. In most cases, these two demographic groups represent the same individuals, showing that those who present at local and regional conferences may already have high levels of expertise and, therefore, may not need more time to acquire new skills. This could be due to their existing knowledge or their ability to learn new skills quickly. Additionally, the finding shows the lowest self-efficacy levels among those teachers who have only been teaching for 1 to 3 years. They score lower than other groups and the average for the group is only standard deviations from the overall average.

During the interview process, multiple participants mentioned the focus the school has on hiring the right people for positions, that they look for teachers who have high self-efficacy and an enthusiasm for teaching. Minarets appears to support teachers in developing higher self-efficacy by supporting them through the four main sources of self-efficacy mentioned in the literature review. Minarets seeks to provide mastery experiences for their teachers, and then expects them to share those experiences with other teachers. The whole school is supported by the vicarious experiences that each teacher sees in this small rural school. They are also very

confident in each other and provide the support and training necessary for each to succeed. Finally, the administration provides a safe environment for continuous growth in every teacher. This focus on hiring the right teachers and providing them with the support they need likely gives them a very positive outlook on their ability to utilize technology effectively and efficiently.

Teachers' attitude toward instructional technology. To measure teachers' attitudes towards instructional technology, this study utilized the TAC/TAT (Teachers' Attitude Towards Computers, Teachers' Attitude Towards Information Technology) short form. The findings of this study show that the teachers at Minarets score almost exactly in the middle of the scale on the TAC and score much higher on the TAT. Both the TAC and TAT assessments measured an email factor and, in both cases, the email portion of the assessment scored the lowest. One interview did reveal that email is not the preferred communication tool at Minarets, but that other tools like the Learning Management System and various social media sites, such as Twitter, are used more widely to communicate.

The TAC portion of the data reveals that the highest areas of the assessment were the Comfort, Concern and Perception factors, which measured one's anxiety towards technology, one's thoughts on the impacts of technology, and one's emotion towards using technology, respectively. In a 1-to-1 technology-based high school one might expect all of the scores to be higher, especially in the interest and utility factors (enthusiasm and enjoyment in using technology and usability of classroom technology, respectively), but this may be a sign of the time and dedication required to constantly revise a project-based curriculum. Through the interview process, the researcher

learned of the dedication teachers at Minarets have to create a meaningful and unique experience for students, and that it takes a lot of energy and time to explore new ways to integrate technology. This could be why the interest and utility factor scores are lower than expected.

The TAT measures teachers' attitudes towards five subscales (factors). The findings show that the teachers score high in 4 out of 5 factors. The lowest, as previously mentioned, was the email factor, which aligns with the TAC results. The two highest factors were the WWW factor (A8) and Multimedia factor (A9) which match perfectly with Minarets High School being a 1-to-1, project-based learning school with a focus in media. The third and fourth highest factors were teacher productivity (A10) and student productivity (A11). Teacher productivity was less than 1 SD higher than student productivity, and both factors were at the high end of the scale, but neither measured as high as the WWW and Multimedia factors. Once again, the presenters' groups scored the highest (except in the email factor) followed closely by the teachers with 1-3 years teaching in a 1-to-1 classroom setting. This shows the importance of experience in utilizing technology in the classroom and also the experience in being a technology integration expert and presenting to others.

Teachers' attitudes toward instructional technology (a combination of the TAC and TAT assessments) reveals that Minarets teachers have positive self-perceptions about their attitude toward the technology that is used at Minarets. Although the findings do not paint a perfect picture across all factors, those factors that appear to be valued the most at Minarets are on the high side. There is room and freedom for teachers to have a variety of attitudes toward technology that may shift from year to

year, or project to project. A teacher's self-efficacy in teaching at a school like Minarets may, in fact, have connections with the teacher's attitude toward the technology that is available to them.

Relationships between teachers' self-efficacy and attitude toward instructional technology. This study used Pearson-r correlations to examine the relationships between the factors of the TSES efficacy survey instrument and the factors of the TAC/TAT attitude survey instrument. The findings reveal that the strongest and most significant correlations exist with the TSES-Student Engagement factor (E1). The Student Engagement factor does not have any significant correlations with the TAC portions of the survey, but does have strong correlations with 3 TAT factors. These strong correlations are with the TAT overall factor, TAT-email factor (A7) and TAT-Teacher Productivity factor (A10). Each of these correlations is statistically significant in the sample population, and the strongest relationship and lowest p-value are between TSET-Student Engagement and TAT-Teacher Productivity. This finding is significant because a high measure of teacher productivity should predict a high measure of student engagement. If schools can develop the skills and self-efficacy in teachers, then their productivity should improve, resulting (according to this correlation) in increased student engagement. This would be an import factor to focus on for any school that wished to deeply incorporate education technology into the classroom.

Relationships between teachers' self-efficacy and student productivity. One of the questions the research was looking to answer was to find relationships between Teacher Self-Efficacy and Student Productivity. The findings for this question are found in Table 12. The findings show several very strong and strong positive and negative

correlations. Unfortunately, the limited number of participants did not provide statistical significance to any of these correlations. Some interesting comparisons could have been made if the case study had a larger target population, but with only 21 staff members eligible for the study, this could not be completed at Minarets High School and Minarets International Charter High School.

Factors that promote the use of technology in the classroom by and for students. Chawanakee Unified School District is a growing rural mountain district with fewer than 1300 students, and schools that will soon be up to 40 miles apart from each other. In 2008 they opened their first and only high school, Minarets. The school started from day one as a 1-to-1 technology rich school using Apple MacBook utilizing a custom project-based learning curriculum. To understand how the district and school support this new venture, the researcher conducted interviews with 9 participants. Through an interview coding process, the findings from these interviews show many attributes of the systems that allows Minarets to provide this one of a kind learning environment in a remote location 20 miles south of Yosemite National Park. The researcher has used these attributes to create the Technology Integration Framework at Minarets (see figure 3).

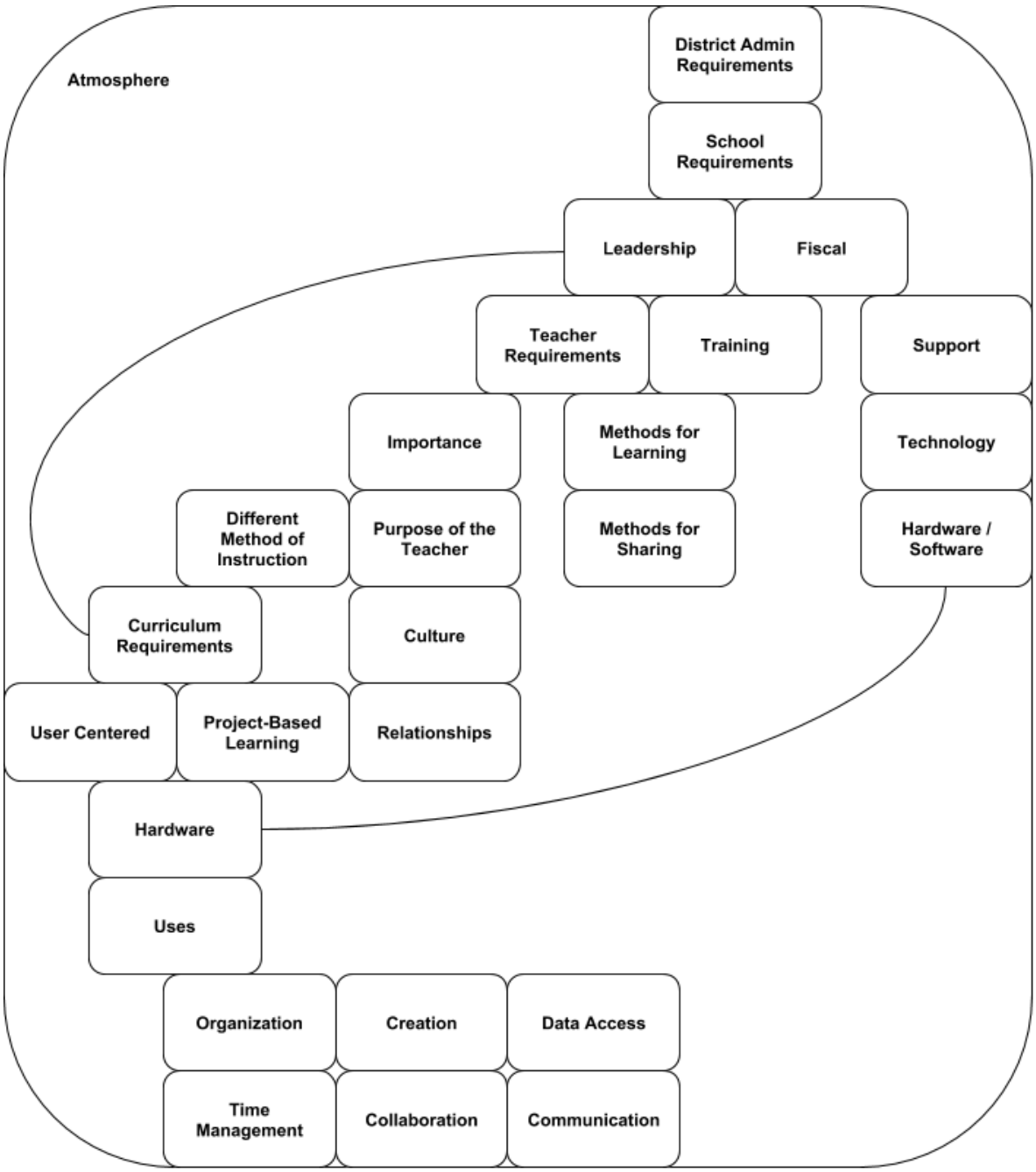

Figure 3. Technology integration framework at Minarets. This figure illustrates the connections found between the 27 attributes identified through the interview process.

This framework was developed to show the connections between the attributes presented by the participants who create an *atmosphere* of learning at Minarets. An

atmosphere is a place with a pervading tone or mood, and Minarets has an atmosphere unlike any other. The framework displays the components that have made this atmosphere possible at Minarets, and provides a tool for duplicating a similar atmosphere at other school sites.

At the top of the framework are the administrative components of a school district (Superintendent, school administration and the community, as represented through the School Board). With absolute support from the administration the framework has infinite potential; with less than absolute support that potential decreases exponentially. The reason administration is so important is because of the leadership and fiscal support they provide. The vision for the district has been created by the leadership and has been fully backed with the necessary resources, including hiring the right teachers, providing the right training opportunities to successfully integrate technology into every classroom, and with the support of IT staff, equipment and access to laptops for every student and staff member.

The foundational belief that technology integration is the right step to take for today's students is not enough. Schools need teachers that know the importance of technology in today's world and are willing to spend the time to create meaningful projects that will be able to translate into the real world. Teachers at Minarets understand the purpose of the teacher in guiding students using constructivist methods grounded in project-based learning. They create projects that guide students to master the standards in an indirect way and focus on the growth of each student. The size of the school allows for teachers and students to connect and build relationships around and through the project-based curriculum. This user centered focus truly puts the

students in control of their learning and, circling back to the technology, allows them to lead their own learning.

Students at Minarets know that the atmosphere here is different. It is not the elevation, or the mountain air; it is the knowledge that the school and district believe in their ability to take on flexible projects, and with 24/7 access to technology, they can create amazing things. As one interviewee said, “The technology is the enhancement, it's the icing on the cake. It's the thing that helps drive that forward if you will, but it’s the underlying rock in getting kids to create meaningful things.” Chawanakee Unified has built this Technology Integration Framework to provide a different learning atmosphere and is extending its reach far beyond the district boundaries. This leads one to wonder, what are the influencers that allow Minarets to provide a “unique experience” for every student?

Influencers

The 27 elements identified in the Technology Integration Framework are what allows Chawanakee Unified to create the atmosphere of learning at Minarets High School and Minarets International Charter High School. The elements themselves have some common connections that allowed the researcher to identify the major components that affect student experience, what the researcher has identified as *Influencers*. These influencers have a cumulative affect that can be seen in Figure 4.

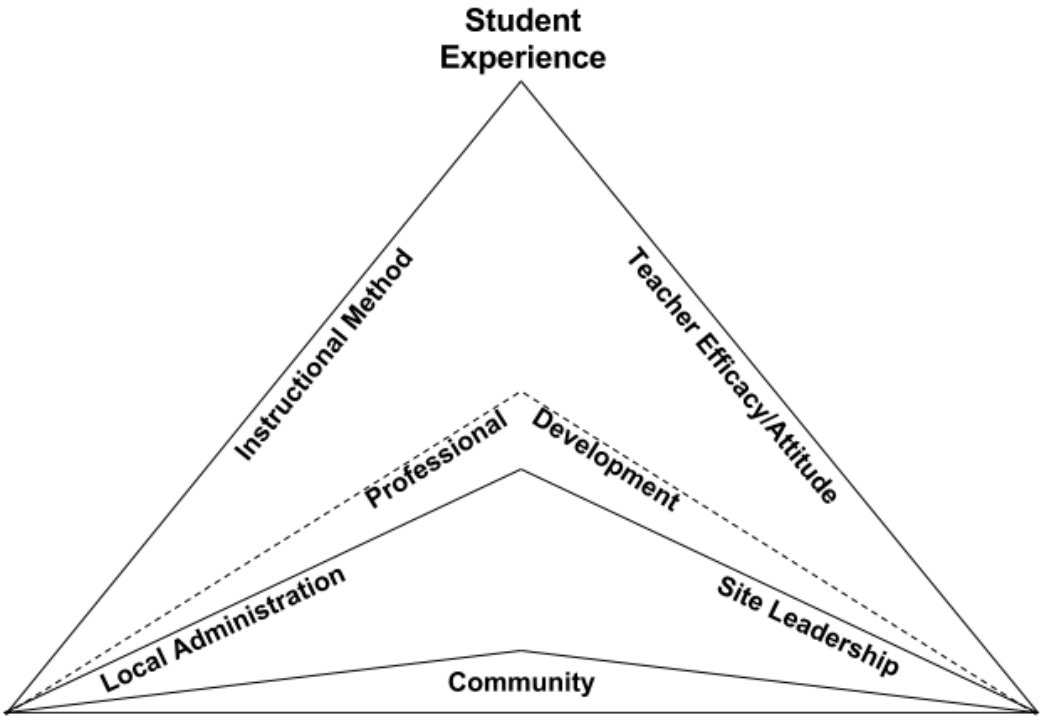

Figure 4. Student experience influencers. This figure illustrates the *influencers* that were isolated through the examination of the 27 elements.

The base tier consists of the *Community* and their influence on the school district. This community-based foundation guides the direction of the school board and administration and influences the programs that will be offered. For example, at Minarets High School all science courses are centered around the Ag Sciences, instead of being the traditional courses (Biology, Chemistry, …). This is due in part because of the community support for a top-quality Ag program, and the intentionality of Minarets to design coursework that has a focus on career opportunities. The community is the foundation of any district, but there are many more influencers.

The middle tier is composed of the decision makers of any district. On the left-hand side is the *Local Administration*. The polices are written, curriculum and programs

are chosen, and fiscal resources are allocated by this set of influencers. At Minarets High School the district has chosen to provide every high school student with an Apple MacBook Air, with 24/7 access. This one choice provides benefits that any other choices in technology could not provide, and has an influence on what projects can be completed. The right-hand side consists of the *Site Leadership*, those individuals on site who guide the sites' program implementation. These school site leaders can be the school's administrators, but can also be coaches, teachers, or whoever takes the lead in deciding how the school teaches students. This group of site-based influencers plays a key role in the student experience through the coursework and student expectations. Combined, the Local Administrator and Site Leadership influencers plan and fund the *Professional Development* (PD) that is available to staff. The professional learning opportunities that are provided to teachers will permeate, to varying degrees, into the top tier where the greatest change in student experience occurs.

The top tier focuses on the influence that teachers have on the learning experience. Teaching is a very complex art form, but this study identified two areas of influence, Instructional Method, and Teacher Efficacy/Attitude. Professional development often is focused on one or both of these areas by building content knowledge or building confidence in oneself. Whatever instructional methods are being used, teachers need to develop the skill set to implement the curriculum effectively. For Minarets High School this is a Project Based method, and the effectiveness of this method has been able to grow over several years. Along with the content knowledge, teachers need to have the self-efficacy and attitude that allow students to experience the full breadth of the chosen instructional method. This study has explored the self-

efficacy and attitudes of teachers in depth, and when combined with the instructional methods, the teachers are found to have the most direct influence on the student experience. How students engage with the curriculum is the teachers' choice, and this can be limited by lack of content knowledge and lack of confidence in oneself and the methods. These teacher traits influence the student experience, and at Minarets, this specifically influences the use of technology for projects across every course offered.

Finally, there is the influencer at the tip, where we must recognize that the student experience does not exist without the student. Each student brings their own set of background experiences and future desires, their own efficacy in learning, and a personalized skill set in using various learning methods. At Minarets High School, for example, students are given 24/7 access to technology in a school that focuses on relevant project-based learning, where every student can explore their own interests for each project. Media students can use a variety of visual media in each of their school projects to meet their learning objectives. There seems to be no limits to what students can do, but the final decision on student experience is an individual one.

The seven influencers that were identified in this study (Community, Local Administration, Site Leadership, Professional Development, Instructional Method, Teacher Efficacy/Attitude, Student Experience) each have an effect on the overall student experience. Visualized in figure 4, each tier can have an increased or decreased magnitude causing a change in the student experience. Additionally, each influencer can pull with greater influence, leaning to the left or right, again affecting the student experience. These movements provided by each influencer may account for

the difference in the student experience from one site to another and from student to student.

Implications

These findings have implications for districts and their schools that are either in a transitional path to full 1-to-1 technology implementation, or have plans to integrate technology into the curriculum. This study has shown some of the valuable characteristics found in the Minarets staff that allows for the use of technology, not only by the teachers, but also by the students. Minarets High School and Minarets International Charter High School has the success it does because of the teachers who are hired and their high self-efficacy, positive attitude towards technology and their constant drive to create a unique learning experience for every child. They could not have the learning environment they have if it were not for the 24/7 access to technology.

The level of access a student has to technology is not the only important attribute that the research found at Minarets. The Technology Integration Framework (figure 3) shows how deep the commitment and support is throughout the school and district. If anything can be learned from this study, it is that all of the stakeholders must have an investment in the meaningful use of technology, and have a plan to sustain the program. To be a cutting-edge school with the deepest integration of technology, the school must stay on top of current trends, learning methodologies, and hardware/software used in industry. Chawanakee Unified has shown how continued support for a decade can keep pushing the schools to provide better access and better student programs. In fact, at the end of May, they announced the construction of an

85,000-square foot football/soccer field with an 8-lane track. Time and time again, the district has shown its investment in advancing programs for students.

The framework revealed through the interviews shows the level of top down support required, and provides an indication of what other schools/districts may need to consider as they develop their own 1-to-1 technology and project-based programs. Minarets truly has a culture that has been affected by all of the influencers (figure 4). If any of the identified influencers were missing or different, then Minarets would not be able to provide the same experience for the students that choose to attend the school. Commitment from the administration, staff, students, and community is critical to Minarets' success. Without this support and the intentionality of being different from other schools, Chawanakee Unified would not be able to have the most successful high school in Madera County that pulls over half of its high school students from surrounding school districts, some that are even out of the county. Minarets is special, and the findings in this study can help other schools develop a special school of their own.

Suggestions for Future Research

The limitations previously identified in this study provide an opportunity for further research. The first limitation is that all of the participant data were self-reported, which can introduce biases into the data. Future studies could utilize follow-up interviews to confirm the self-reported results found through survey instruments. These interviews would allow the researcher to get a better feel of the results to better understand if the survey provided accurate results.

The second limitation is the size of the study. Even with 73% of the staff members participating, the size of the school limited the possible responses. If the study was expanded to other sites, then the data may have more statistically significant. Specifically, the correlational data by demographic groups was inhibited by the size of the population. If the sample population could be increased in the future, the analysis may provide a variety of useful information.

The third limitation of the study is that only four (4) demographic characteristics were included in this study (Years Teaching, Years Teaching 1-to-1, Hours Spent Learning New Technology Skills, and Presents at Conferences). There could be many other factors that could be used to study a population, but due to the second limitation, the demographic characteristics were limited to those that could not be used to identify a specific participant.

The fourth limitation of this study is that all research was completed by the researcher only, and that no one else validated the work. The researcher did conduct the interviews, recording, and transcription, and used multiple iterations to identify the categories, themes, and influencers identified in this study.

The interview process of this study allowed the researcher to create the *Technology Integration Framework at Minarets* found in figure 3. Further study could be done by looking at the validity of the framework. This might include finding similar project-based high schools that infuse technology. An example of such a school may be High Tech High, a public school in San Diego that pulls students from throughout the region, or Nueva's Upper School, a private school in San Mateo. The use of other school sites may allow further development and refinement of the framework.

Finally, the Student Experience Influencers found in figure 4, would benefit from an exploration in the quantification of the values. As stated, the figure is not static, but instead increases or decreases in magnitude, and can shift to the left or to the right. Though none of these positions specifically indicate an ideal student experience, discovering a method to quantify this movement could be influential for the allocation of resources to have the greatest impact on student experience, and therefore learning. The quantifiable application of this concept to a school district could lead to some interesting findings.

Final Thoughts

The outcome of this research suggests that the integration of technology into the modern-day classroom goes much deeper that merely purchasing hardware for the teachers and students to use. The findings show that beyond access, teachers must have the self-efficacy and attitude that promote the use of instructional technology, and have the support to build skills and create a vision for what technology integration looks like in their classroom. It is interesting to note that Teacher Efficacy and Attitude are important factors in using technology effectively, but this study also pointed out the fact that the complexity of the factors of school environment would work against deriving any causal relationship between E and A and student performance. The reality is that the school environment is much more complex than that.

The study also revealed an intricate system that is required for Minarets to provide this unique learning space. Even when the researcher worked at Chawanakee Unified, this level of complexity was unknown. The Technology Integration Framework (figure 3) that was discovered through the interviews helps to visualize the intricacy of

the elements necessary to sustain and grow the programs at Minarets, and can be a powerful tool for any other schools/districts that are looking to provide a similar learning atmosphere for their students to strive for greatness.

Lastly, the study found that there are seven key influencers to the student experience at Minarets. These influencers are comprised of different social groups. Starting at the base is the community, which provides a solid foundation for the school to build upon. Next are the leaders of the district/school, who create the vision of engagement and provide the means to reach that vision. Then there are the teachers, who engage the students through their own content knowledge and teaching skills. Finally, at the tip are the students, each of whom has a direct connection to their own experience. These four groups of influencers have the power to significantly change the student experience at any school, and this study found that professional development (both as the participant and the trainer) is a key influencer in building the learning atmosphere at Minarets.

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APPENDIX A

Permission to Complete Study and use District/School Names

CHAWANAKEE
UNIFIED SCHOOL DISTRICT

33030 Road 228, North Fork, California 93643
Mailing: PO Box 400, North Fork, California 93643
559 877-6209 559 877-2065
www.chawanakee.k12.ca.us
Darren Q. Sylvia
Superintendent

1/21/2017

Pepperdine University
Graduate and Professional Schools Institutional Review Board (GPS IRB)
6100 Center Drive – 5th Floor
Los Angeles, CA 90045

RE: Jeran Ott, M.Ed.,
A Study of the Impact of Teacher Attitude/Efficacy on the Use of Classroom Technology

To GPSIRB:

This letter is to convey that I/we have reviewed the proposed research study being conducted by Jeran Ott, M.Ed intended to conduct research at Minarets High School and Minarets Charter and International High School and find *A Study of the Impact of Teacher Attitude/Efficacy on the Use of Classroom Technology* acceptable.

I/we give permission for the above investigators to conduct research at this site. Chawanakee Unified School District gives explicit permission to have researcher identify the school district name (Chawanakee Unified School District) and high school names (Minarets High School and Minaret Charter & International High School) in his dissertation which will be publicly available upon completion.

If you have any questions regarding site permission, please contact me at 559-877-6209 or dsylvia@mychawanakee.org.

Sincerely,

Darren Sylvia
Superintendent, Chawanakee Unified School District

APPENDIX B

Informed Consent

A Study on the Impact of Teacher Attitude/Efficacy on the Use of Classroom Technology

Dear Participant:

I am a doctoral student under the direction of Dr. Jack McManus at Pepperdine University. I am conducting research as part of the requirements to complete my doctoral dissertation in Educational Technology. The focus of the study is to study the impact of teacher self-efficacy and attitude on the use of educational technology in the classroom. I am inviting you to participate in filling-out the following questionnaire that will help me gather important data on the topic. Additionally, at the end of the questionnaire you will have the opportunity to opt-in for an interview which will be used to triangulate results with the questionnaire.

The questionnaire will take approximately 20-30 minutes (the interview will take-approximately 30 minutes) and your participation is voluntary. If you choose to fill-out the questionnaire your responses may help make a contribution to the information known about teacher self-efficacy and attitudes toward educational technology in the classroom. There are no foreseeable risks or discomforts to your participation. Participants must be 18 or older.

Your individual responses to the questionnaire are anonymous and will only be seen by the research investigator. All data will be kept confidential within a password-protected database kept by the research investigators. The aggregate results of this study may be used in reports, presentations, or publications but your name will never be used.

If you have any questions concerning the research study, please contact Jeran Ott at jeran.ott@pepperdine.edu. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Graduate and Professional Schools Institutional Review Board at (310) 568-5753.

Return of the questionnaire is your consent to participate.

Sincerely,
Jeran Ott

APPENDIX C

Interview Protocol

Time of Interview: _____ Date of Interview: _____

Place: _____ Name of Interviewee: _____

INTERVIEWER SAYS: Thank you for agreeing to meet with me today in order to interview you on your perception of the effects of teacher beliefs on student productivity in a 1-to-1 project-based learning high school. I am earning an educational doctorate in Learning Technology from Pepperdine University and this interview will be used as a part of my dissertation. Do I have your permission to continue this interview for this purpose? I would also like your permission to record this interview for scribing purposes and so that I can access it at a later time.
Do I have your permission to do so?

I have provided a copy of the questions that I will ask for your reference; however, I may also ask some follow up questions for clarity. The duration of this interview will be approximately 30 minutes.
Do you have any questions for me before we begin?
Let's begin. (start recording device)

RESEARCH QUESTIONS

Main What teacher and district/school factors allow for effective technology integration?

RQ1 What relationship, if any, exists between teachers' sense of self-efficacy and teachers' attitudes toward instructional technology?

RQ2 What relationship, if any, exists among the factors of teachers' sense of self-efficacy (Student Engagement, Instructional Practice and Classroom Management) and Student Productivity?

RQ3 What district/school factors, if any, promotes the use of technology in the classroom by and for students?

BACKGROUND QUESTIONS:

1. Please state your full name, current position and subjects you teach.
2. Please tell me your educational background that led you to being an employee at Minarets High School.
3. What are your strategies for advancing your skills in using technology?
4. After learning something new, how do you share what you have learned with others?

RESEARCH QUESTIONS:

5. What is your gut feeling about instructional technology?
    a. Potential Follow-Up Question: How does your perception of instructional technology affect current or future student projects?
6. Please explain what students do with technology in your classes?
    a. Potential Follow-Up Question: What are some examples of projects that students have worked on in your classes?
7. In what ways has the district influenced the use of technology at Minarets?
    a. Potential Follow-Up Question: ?
8. In what ways has Minarets High supported the use of technology by students?
    a. Potential Follow-Up Question: How has Minarets High supported you personally in the use of classroom technology?
9. What makes Minarets different from other schools?
    a. Potential Follow-Up Question: In your opinion, can this environment be duplicated into existing or new schools?

INTERVIEWER SAYS: Is there anything else that you wish to tell me that you feel will help me better understand your perception of the effects of teacher beliefs on student productivity in a 1-to-1 project-based learning high school? Thank you very much for your time today and your willingness to allow me the opportunity to interview you for my doctoral dissertation. If you would like a copy of my research at the conclusion of my study, I will be happy to provide that for you. Please accept this small token of my appreciation for your participation.

APPENDIX D

TSES Survey Instrument Permission

THE OHIO STATE UNIVERSITY COLLEGE OF EDUCATION AND HUMAN ECOLOGY

ANITA WOOLFOLK HOY, PH.D.

PROFESSOR
PSYCHOLOGICAL STUDIES IN EDUCATION

Dear

You have my permission to use the *Teachers' Sense of Efficacy Scale* in your research. A copy of both the long and short forms of the instrument as well as scoring instructions can be found at:

http://www.coe.ohio-state.edu/ahoy/researchinstruments.htm

Best wishes in your work,

Anita Woolfolk Hoy

Anita Woolfolk Hoy, Ph.D.
Professor

COLLEGE OF EDUCATION
29 WEST WOODRUFF AVENUE
COLUMBUS, OHIO 43210-1177

WWW.COE.OHIO-STATE.EDU/AHOY

PHONE 614-292-3774
FAX 614-292-7900
HOY.17@OSU.EDU

APPENDIX E

TSES Survey Instrument

Teachers' Sense of Efficacy Scale[1] (long form)

Teacher Beliefs Directions: This questionnaire is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers in their school activities. Please indicate your opinion about each of the statements below. Your answers are confidential.	How much can you do? Nothing		Very Little		Some Influence		Quite A Bit		A Great Deal
1. How much can you do to get through to the most difficult students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2. How much can you do to help your students think critically?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3. How much can you do to control disruptive behavior in the classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4. How much can you do to motivate students who show low interest in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5. To what extent can you make your expectations clear about student behavior?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6. How much can you do to get students to believe they can do well in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
7. How well can you respond to difficult questions from your students ?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8. How well can you establish routines to keep activities running smoothly?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9. How much can you do to help your students value learning?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
10. How much can you gauge student comprehension of what you have taught?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
11. To what extent can you craft good questions for your students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
12. How much can you do to foster student creativity?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
13. How much can you do to get children to follow classroom rules?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
14. How much can you do to improve the understanding of a student who is failing?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
15. How much can you do to calm a student who is disruptive or noisy?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
16. How well can you establish a classroom management system with each group of students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
17. How much can you do to adjust your lessons to the proper level for individual students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
18. How much can you use a variety of assessment strategies?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
19. How well can you keep a few problem students form ruining an entire lesson?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
20. To what extent can you provide an alternative explanation or example when students are confused?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
21. How well can you respond to defiant students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
22. How much can you assist families in helping their children do well in school?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
23. How well can you implement alternative strategies in your classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
24. How well can you provide appropriate challenges for very capable students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Teachers' Sense of Efficacy Scale[1] (short form)

	Teacher Beliefs Directions: This questionnaire is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers in their school activities. Please indicate your opinion about each of the statements below. Your answers are confidential.	How much can you do? Nothing		Very Little		Some Influence		Quite A Bit		A Great Deal
1.	How much can you do to control disruptive behavior in the classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2.	How much can you do to motivate students who show low interest in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3.	How much can you do to get students to believe they can do well in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4.	How much can you do to help your students value learning?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5.	To what extent can you craft good questions for your students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6.	How much can you do to get children to follow classroom rules?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
7.	How much can you do to calm a student who is disruptive or noisy?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8.	How well can you establish a classroom management system with each group of students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9.	How much can you use a variety of assessment strategies?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
10.	To what extent can you provide an alternative explanation or example when students are confused?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
11.	How much can you assist families in helping their children do well in school?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
12.	How well can you implement alternative strategies in your classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Directions for Scoring the Teachers' Sense of Efficacy Scale[1]

Developers: Megan Tschannen-Moran, College of William and Mary
Anita Woolfolk Hoy, the Ohio State University.

Construct Validity

For information the construct validity of the Teachers' Sense of Teacher efficacy Scale, see:

> Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing and elusive construct. *Teaching and Teacher Education, 17,* 783-805.

Factor Analysis

It is important to conduct a factor analysis to determine how your participants respond to the questions. We have consistently found three moderately correlated factors: *Efficacy in Student Engagement, Efficacy in Instructional Practices*, and *Efficacy in Classroom Management*, but at times the make up of the scales varies slightly. With preservice teachers we recommend that the full 24-item scale (or 12-item short form) be used, because the factor structure often is less distinct for these respondents.

Subscale Scores

To determine the *Efficacy in Student Engagement, Efficacy in Instructional Practices*, and *Efficacy in Classroom Management* subscale scores, we compute unweighted means of the items that load on each factor. Generally these groupings are:

Long Form

Efficacy in Student Engagement:	Items 1, 2, 4, 6, 9, 12, 14, 22
Efficacy in Instructional Strategies:	Items 7, 10, 11, 17, 18, 20, 23, 24
Efficacy in Classroom Management:	Items 3, 5, 8, 13, 15, 16, 19, 21

Short Form

Efficacy in Student Engagement:	Items 2, 3, 4, 11
Efficacy in Instructional Strategies:	Items 5, 9, 10, 12
Efficacy in Classroom Management:	Items 1, 6, 7, 8

Reliabilities

In Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing and elusive construct. *Teaching and Teacher Education, 17,* 783-805, the following were found:

	Long Form			Short Form		
	Mean	SD	alpha	Mean	SD	alpha
OSTES	7.1	.94	.94	7.1	.98	.90
Engagement	7.3	1.1	.87	7.2	1.2	.81
Instruction	7.3	1.1	.91	7.3	1.2	.86
Management	6.7	1.1	.90	6.7	1.2	.86

[1] Because this instrument was developed at the Ohio State University, it is sometimes referred to as the *Ohio State Teacher Efficacy Scale.* We prefer the name, *Teachers' Sense of Efficacy Scale.*

APPENDIX F

TAC/TAT Survey Instrument Permission

From: **Muller, Mary Ann** MaryAnn.Muller@taylorandfrancis.com
Subject: RE: Use of Article/Survey Request (DOI:10.1080/07380569.2011.621830)
Date: December 20, 2013 at 8:08 AM
To: Jeran Ott jeran.ott@pepperdine.edu

Hello, Ms. Ott:
Our article is Open Access.
Please feel free to download it from our website for the use of the survey instrument as well as other aspects of the article.
Thank you for writing.

Mary Ann Muller – Permissions Coordinator, US Journals Division
Please Note My New Work Schedule Beginning September 3rd: Monday, Tuesday, Friday

Go to: www.tandfonline.com to use RightsLink, our online permissions web page for immediate processing of your permission request.

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From: **Jeran Ott** Jeran.Ott@pepperdine.edu
Subject: Use of Article/Survey Request (DOI:10.1080/07380569.2011.621830)
Date: December 18, 2013 at 10:56 AM
To: USJournalPermissions@taylorandfrancis.com

Hello,

My name is Jeran Ott, and I am working on my dissertation and have been looking at using several surveys on teachers attitudes toward computers. On monday I found an article listed below that undated and condenses two of the surveys am planning to use into a single smaller survey instrument. I would like to ask permission to use the survey instrument created in this article. I am not sure who to ask for permission from, so I am starting with the publisher as I would also need to reference other aspects of the article.

1. Measuring Teacher Attitudes Toward Instructional Technology: A Confirmatory Factor Analysis of the TAC and TAT
   Dominick Shattuck, Kristen A. Corbell, Jason W. Osbourne, Gerald Knezek, Rhonda Christensen, Lisa Leonor Grable
   Computers in the Schools
   Vol. 28, Iss. 4, 2011

Thank you for your time and in helping me gain permission to use the instrument created in this article.

Cordially,

Jeran Ott
Mathematics/Technology Teacher
Pepperdine Education Technology Doctorate Student
"You can't go anywhere if You don't keep moving!" Jeran Ott, 1/22/09

APPENDIX G

TAC/TAT Survey Instrument

TABLE 11 TAC & TAT Combined Questions

Likert Scale
Directions: Please read the items and select the best response.

Subscale/Item		Response options				
Interest*						
1-3	The challenge of learning about computers is exciting.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1-5	I like learning about computers.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
8-1	I like to talk to others about computers.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
8-2	It is fun to figure out how computers work.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
8-3	If a problem is left unsolved in a computer class, I continue to think about it afterward.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
8-5	The challenge of solving problems with computers does not appeal to me.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
8-6	When there is a problem with a computer that I can't immediately solve, I stick with it until I have the answer.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Comfort*						
2-1	I get a sinking feeling when I think of trying to use a computer.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
2-2	Working with a computer makes me feel tense and uncomfortable.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
2-4	Computers intimidate me.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Interaction e-mail*						
4-2	The use of e-mail helps provide a better learning experience.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

4-3	The use of e-mail makes a class more interesting.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
4-4	The use of e-mail helps the student learn more.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
4-5	The use of e-mail increases motivation for class.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Subscale/Item	Response options					
Concern*						
5-3	Computers dehumanize society by treating everyone as a number.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
5-4	Our country relies too much on computers.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
5-5	Computers isolate people by inhibiting normal social interactions.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
5-6	Computers have the potential to control our lives.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
5-7	Working with computers makes me feel isolated from other people.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Utility*						
6-2	Computers can help me learn.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
6-3	Computers are necessary tools in both educational and work settings.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
6-4	Computers can be useful instructional aids in almost all subject areas.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
6-7	Computers could enhance remedial instruction.	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

Semantic Differential Questions

Choose one location between each adjective pair to indicate how you feel about computers. Please consider the following question when completing the following 4 questions.

Perception*

"Computers are _____."

7-2	suffocating	○ ○ ○ ○ ○ ○ ○	fresh
7-3	dull	○ ○ ○ ○ ○ ○ ○	exciting
7-4	unlikable	○ ○ ○ ○ ○ ○ ○	likeable
7-7	unhappy	○ ○ ○ ○ ○ ○ ○	happy

(Continued on next page)

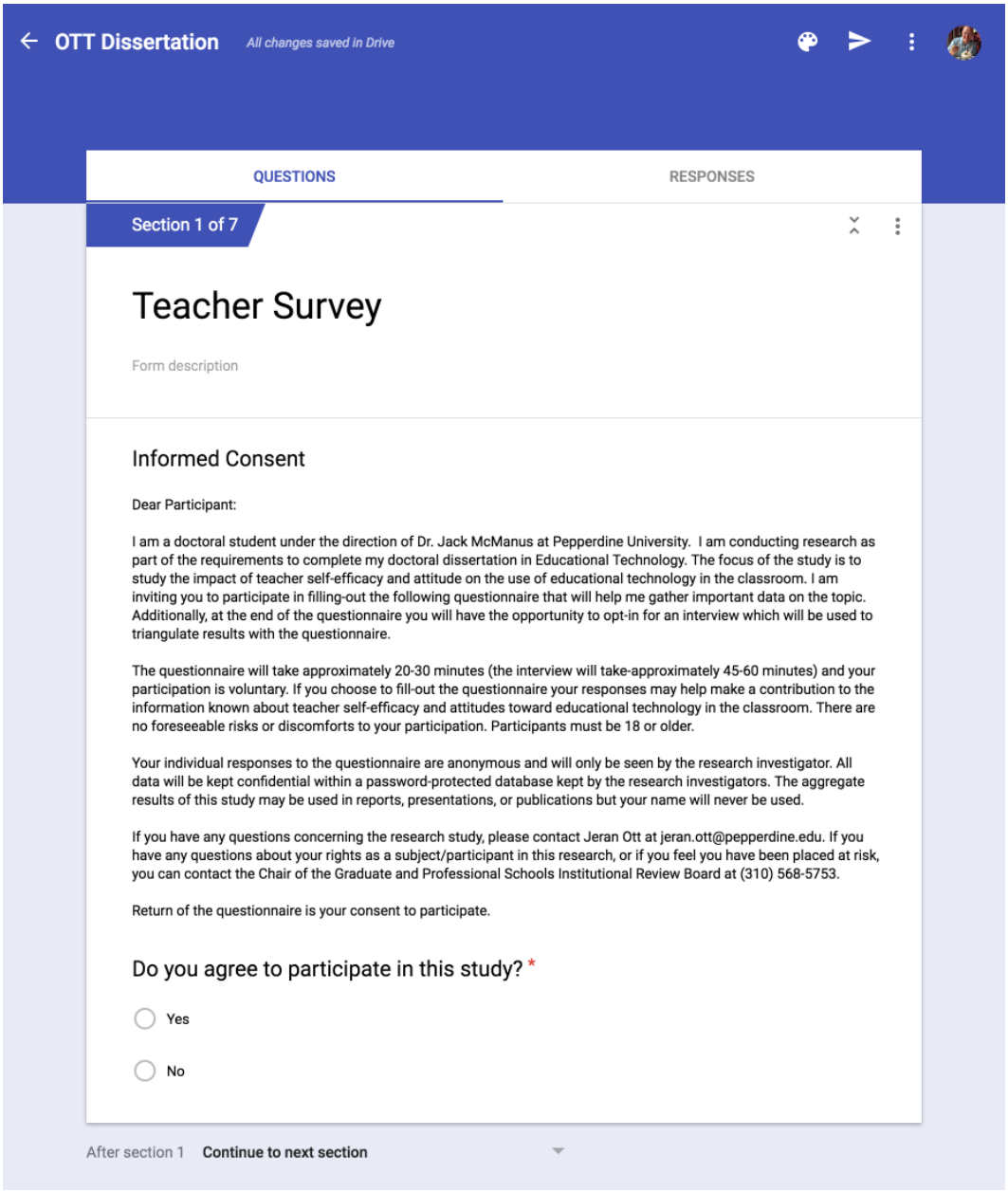
TABLE 11 TAC & TAT Combined Questions *(Continued)*

E-mail**			
"To me, electronic mail (e-mail) is _____."			
tatv14	exciting	○ ○ ○ ○ ○ ○ ○	unexciting
tatv16	appealing	○ ○ ○ ○ ○ ○ ○	unappealing
tatv17	fascinating	○ ○ ○ ○ ○ ○ ○	mundane
WWW**			
"To me, using the World Wide Web (WWW) is _____."			
tatv24	exciting	○ ○ ○ ○ ○ ○ ○	unexciting
tatv26	appealing	○ ○ ○ ○ ○ ○ ○	unappealing
tatv27	fascinating	○ ○ ○ ○ ○ ○ ○	mundane
Multimedia**			
"To me, multimedia (for example, HyperStudio, KidPix, ezedia, etc.) is _____."			
tatv34	exciting	○ ○ ○ ○ ○ ○ ○	unexciting
tatv36	appealing	○ ○ ○ ○ ○ ○ ○	unappealing
tatv37	fascinating	○ ○ ○ ○ ○ ○ ○	mundane
Teacher Productivity			
"To me, using computers for my professional productivity is ____."			
tatv44	exciting	○ ○ ○ ○ ○ ○ ○	unexciting
tatv46	appealing	○ ○ ○ ○ ○ ○ ○	unappealing
tatv47	fascinating	○ ○ ○ ○ ○ ○ ○	mundane
Student Productivity			
"For my students, using computers in the classroom is _____."			
tatv54	exciting	○ ○ ○ ○ ○ ○ ○	unexciting
tatv56	appealing	○ ○ ○ ○ ○ ○ ○	unappealing
tatv57	fascinating	○ ○ ○ ○ ○ ○ ○	Mundane

Note. *Taken from TAC
**Taken from TAT

APPENDIX H

Final Combined Survey Instrument



Section 2 of 7

Demographics

Description (optional)

Years Teaching

1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10
11. 11
12. 12
13. 13
14. 14
15. 15
16. 16
17. 17
18. 18
19. 19
20. 20 or more

Years teaching in 1-to-1 school

1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10
11. 11
12. 12
13. 13
14. 14
15. 15
16. 16
17. 17
18. 18
19. 19
20. 20 or more

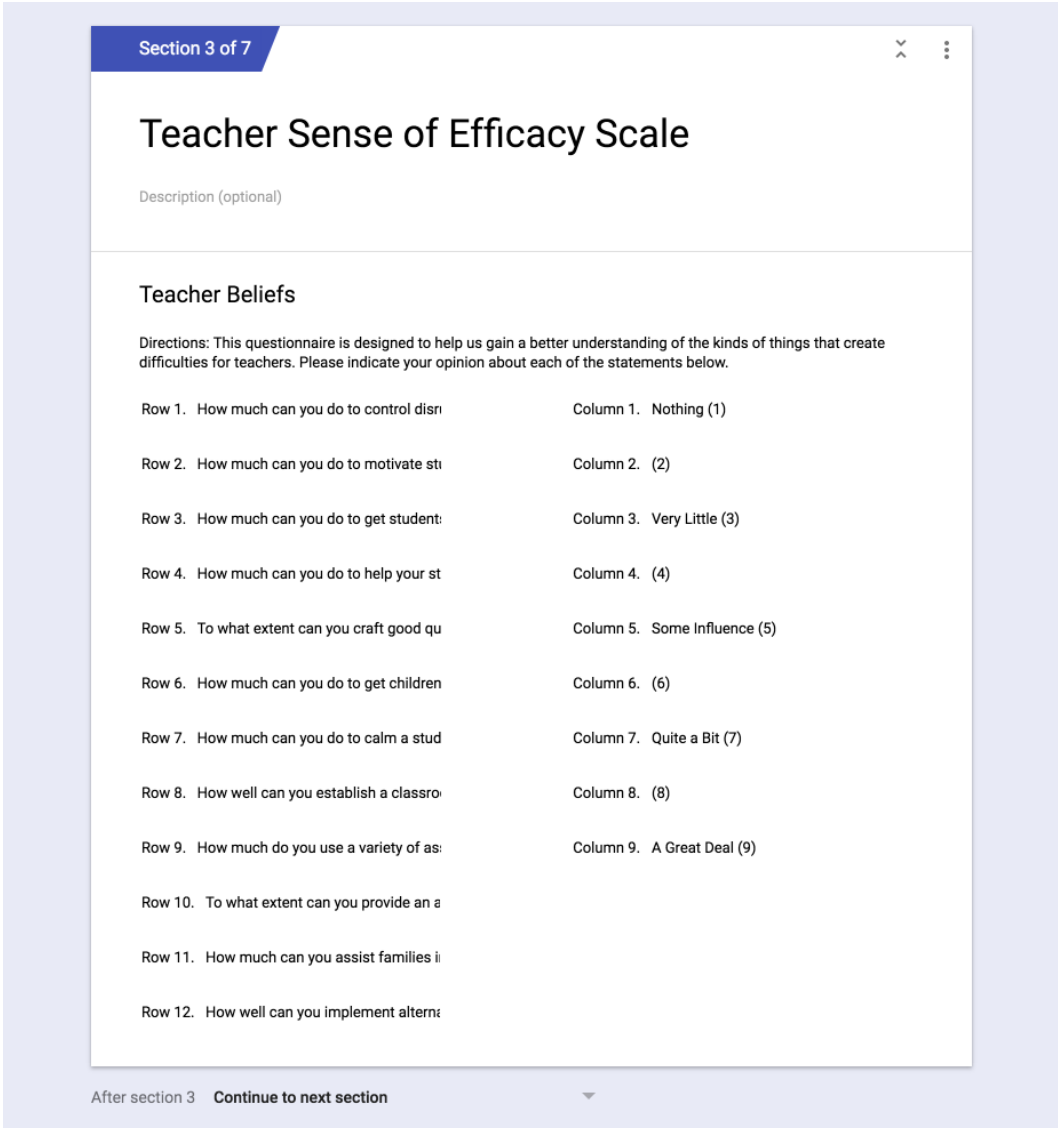
How many hours per week do you spend learning new technology-based skills to use in your teaching practice?

1. 0-1 hour
2. 1-3 hours
3. 3-5 hours
4. 5+ hours

On average at how many conferences are you a presenter at each year?

1. 0
2. 1
3. 2
4. 3 or more

After section 2 **Continue to next section**


Section 3 of 7

Teacher Sense of Efficacy Scale

Description (optional)

Teacher Beliefs

Directions: This questionnaire is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers. Please indicate your opinion about each of the statements below.

Row 1. How much can you do to control disr	Column 1. Nothing (1)
Row 2. How much can you do to motivate st	Column 2. (2)
Row 3. How much can you do to get student	Column 3. Very Little (3)
Row 4. How much can you do to help your st	Column 4. (4)
Row 5. To what extent can you craft good qu	Column 5. Some Influence (5)
Row 6. How much can you do to get children	Column 6. (6)
Row 7. How much can you do to calm a stud	Column 7. Quite a Bit (7)
Row 8. How well can you establish a classro	Column 8. (8)
Row 9. How much do you use a variety of as	Column 9. A Great Deal (9)
Row 10. To what extent can you provide an a	
Row 11. How much can you assist families i	
Row 12. How well can you implement alterna	

After section 3 **Continue to next section**

Section 4 of 7

Attitudes

Description (optional)

Question

Row 1. The challenge of learning about comp	Column 1. Strongly Disagree
Row 2. I like learning about computers	Column 2. Disagree
Row 3. I like to talk to others about computer	Column 3. Undecided
Row 4. It is fun to figure out how computers	Column 4. Agree
Row 5. If a problem is left unsolved in a com	Column 5. Strongly Agree
Row 6. The challenge of solving problems wi	
Row 7. When there is a problem with a comp	

Question

Row 1. I get a sinking feeling when I think of	Column 1. Strongly Disagree
Row 2. Working ith a computer makes me fe	Column 2. Disagree
Row 3. Computers intimidate me	Column 3. Undecided
	Column 4. Agree
	Column 5. Strongly Agree

Question

Row 1. The use of e-mail helps provide a bet	Column 1. Strongly Disagree
Row 2. The use of e-mail make a class more	Column 2. Disagree
Row 3. The use of e-mail helps the students	Column 3. Undecided
Row 4. The use of e-mail increases motivatic	Column 4. Agree
	Column 5. Strongly Agree

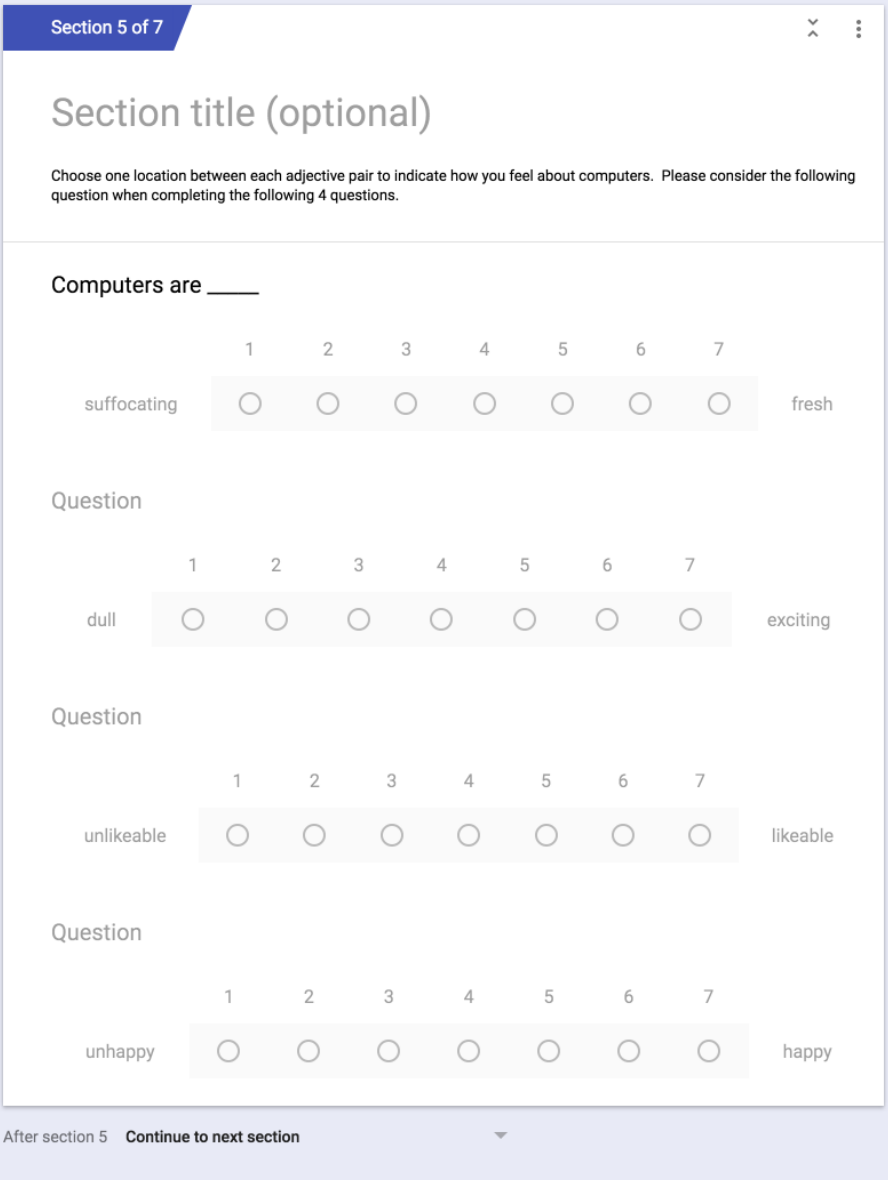
Question

Row 1. Computers dehumanize society by tr	Column 1. Strongly Disagree
Row 2. Our country relies too much on comp	Column 2. Disagree
Row 3. Computers isolate people by inhibitin	Column 3. Undecided
Row 4. Computers have the potential to cont	Column 4. Agree
Row 5. Working with computers makes me f	Column 5. Strongly Agree

Question

Row 1. Computers can help me learn	Column 1. Strongly Disagree
Row 2. Computers are necessary tools in bot	Column 2. Disagree
Row 3. Computers can be useful instructiona	Column 3. Undecided
Row 4. Computers could enhance remedial i	Column 4. Agree
	Column 5. Strongly Agree

After section 4 **Continue to next section**


Section 5 of 7
Section title (optional)
Choose one location between each adjective pair to indicate how you feel about computers. Please consider the following question when completing the following 4 questions.
Computers are _____
1 2 3 4 5 6 7
suffocating
fresh
Question
1 2 3 4 5 6 7
dull
exciting
Question
1 2 3 4 5 6 7
unlikeable
likeable
Question
1 2 3 4 5 6 7
unhappy
happy
After section 5 Continue to next section

Section 6 of 7

Section title (optional)

Choose one location between each adjective pair to indicate how you feel. Please consider the following questions when completing the following questions.

"To me, electronic mail is _____"

	1	2	3	4	5	6	7	
exciting	○	○	○	○	○	○	○	unexciting
appealing	○	○	○	○	○	○	○	unappealing
fascinating	○	○	○	○	○	○	○	mundane

"To me, using the World Wide Web (Internet) is _____"

	1	2	3	4	5	6	7	
exciting	○	○	○	○	○	○	○	unexciting
appealing	○	○	○	○	○	○	○	unappealing
fascinating	○	○	○	○	○	○	○	mundane

"For me, multimedia is _____"

	1	2	3	4	5	6	7	
exciting	○	○	○	○	○	○	○	unexciting

	1	2	3	4	5	6	7	
appealing	○	○	○	○	○	○	○	unappealing

	1	2	3	4	5	6	7	
fascinating	○	○	○	○	○	○	○	mundane

"To me, using computers for my professional productivity is _____"

	1	2	3	4	5	6	7	
exciting	○	○	○	○	○	○	○	unexciting

	1	2	3	4	5	6	7	
appealing	○	○	○	○	○	○	○	unappealing

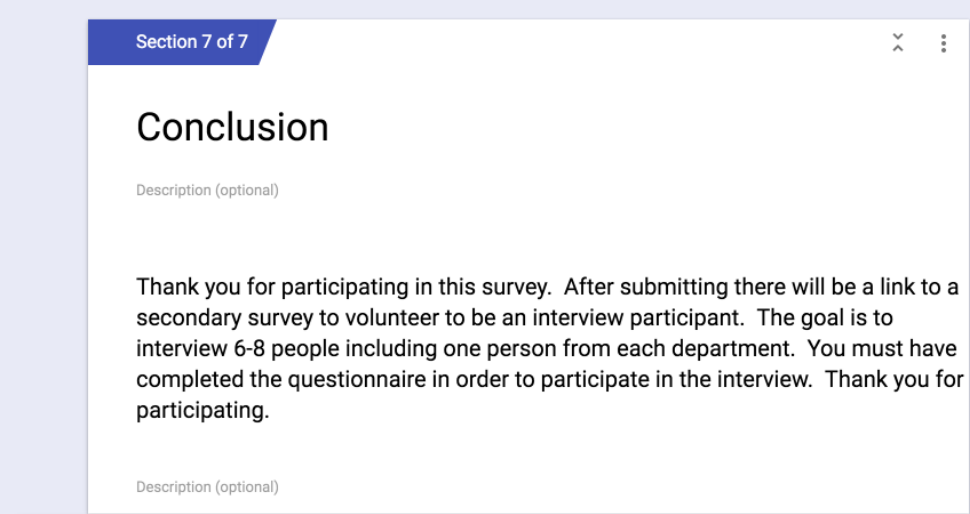
	1	2	3	4	5	6	7	
fascinating	○	○	○	○	○	○	○	mundane

"For my students, using computers in the classroom is _____"

	1	2	3	4	5	6	7	
exciting	○	○	○	○	○	○	○	unexciting

	1	2	3	4	5	6	7	
appealing	○	○	○	○	○	○	○	unappealing

	1	2	3	4	5	6	7	
fascinating	○	○	○	○	○	○	○	mundane


Section 7 of 7
Conclusion
Description (optional)
Thank you for participating in this survey. After submitting there will be a link to a secondary survey to volunteer to be an interview participant. The goal is to interview 6-8 people including one person from each department. You must have completed the questionnaire in order to participate in the interview. Thank you for participating.
Description (optional)

APPENDIX I

IRB Approval Letter

Pepperdine University
24255 Pacific Coast Highway
Malibu, CA 90263
TEL: 310-506-4000

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Date: February 16, 2017

Protocol Investigator Name: Jeran Ott

Protocol #: 17-01-504

Project Title: A Study on the Impact of Teacher Attitude/Efficacy on the Use of Classroom Technology

School: Graduate School of Education and Psychology

Dear Jeran Ott:

Thank you for submitting your application for exempt review to Pepperdine University's Institutional Review Board (IRB). We appreciate the work you have done on your proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations 45 CFR 46.101 that govern the protections of human subjects.

Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit an amendment to the IRB. Since your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite the best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete written explanation of the event and your written response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* at community.pepperdine.edu/irb.

Please refer to the protocol number denoted above in all communication or correspondence related to your application and this approval. Should you have additional questions or require clarification of the contents of this letter, please contact the IRB Office. On behalf of the IRB, I wish you success in this scholarly pursuit.

Sincerely,

Judy Ho, Ph.D., IRB Chair

APPENDIX J

Interview Data

Table J1

Strategies for Advancing Technology Skills

Element: Methods for Learning	• Self-taught (*n*=11) • Taught by others (kids/teachers/mentors) (*n*=11) • Lead by/for Curriculum Enhancement (need to improve a lesson) (*n*=1) • Collaboration with others (meetings, conferences, social networks) (*n*=5) • External Professional Development (*n*=5)
• "A lot of mine comes from personal research. When I see anything in various educational blogs, I'll look into it and I'll try it see what works." • "A lot of it is just trial and error, figuring out stuff as it's shown to me." • "The students actually teach me a lot. They find different things that I'm able to use." • "I learned by problem solving. Most of my stuff is just self-taught. I just have a problem that I need to solve and I find a solution." • "It's kind of evolved over time. At first, I did a lot of conferences and workshops and since I've been to a lot of those and I've been part of the Apple Distinguished Educator Program and presented at conferences, it's become more of I have resources people that are in my learning network that I reach out to and talk to and sit with and I learn from them more, and then just researching on my own." • "It initially started with me just messing around on the computer and trying to figure things out or trying to do things better ways, looking stuff up. Then I got really plugged into CVCUE conferences, then with Google conferences; so conferences are a big deal and presenting. Then I started pursuing actual college classes. I started with Google, then I did some online courses, and I became a Google certified and all of that and I'm also a Google Innovator, and then starting my masters in EdTech."	

Table J2

Methods for Sharing with Others

Element: Methods for Sharing	• Direct share (students, teachers, …) (*n*=9) • Apply to classwork (share directly with students) (*n*=1)

(continued)

	• In-direct share (tutorials, blogs, playbook, presentations, …) (*n*=11)
• "With my students, I actually walk them through pieces by having it projected up on the board and just walking them through doing it at the same time, so that it's a step-by-step process with them." • "I usually mention it, like if I can think of a certain person that might benefit from it I'd be like "hey why don't you try this in your class. This is how I used…". This is usually how it goes." • "I've created something we call the Minarets Playbook, which features things like the 7 P's of project-based learning and just kind of specific ways to teach with technology and project-based learning. We've developed resources and that so through direct presentations and through some of the documents and forms and training sessions that we've created. " • "If I find something that I believe teachers need to follow or something that might be a step complex, I'll usually do some sort of a walk-through tutorial video. Usually they're anywhere between three to seven minutes I try to keep them in length and I published those. Other times I do fairly clear and concise visual learning steps. So, if it's an eight-step process, I'll do the steps in text, but also do the steps in visual in screen grabs and I'll produce documents. Sometimes I'll do it as PDF." • "Typically, it's post on Twitter is mostly what I do. So posting it there, blog posts. If it relates to what I'm presenting on. Or just collaborating with people when I'm at conferences tends to be the best way."	

Table J3

Feelings About Instructional Technology

Element: Importance	• Future (*n*=4) • Necessary (*n*=8) • Key in Special Ed. (*n*=3)
Element: User-centered	• Personal love (*n*=2) • Personalized (*n*=1) • Positive mindset (*n*=1) • Engagement (*n*=2)
Element: Purpose of the Teacher	• Good teacher Required (*n*=2) • More powerful/effective teachers (*n*=1) • On demand access to resources (*n*=2) • Sharing Resources (*n*=2) • Onus on teachers to lead learning (*n*=1) • What is the value-add? (*n*=1) • Laptop cannot be everything, still need teachers (*n*=1)

(continued)

	• Monitor students' use and control when needed (*n*=1)
Element: Different Method of Instruction	• Change in Instructional Model (*n*=2) • Innovative/transformative/creative (*n*=5) • Modality shift (*n*=3) • So much more interesting (*n*=1) • Students value technology access (*n*=1) • Technology is ingrained in learning (*n*=1) • Continuous skills growth (*n*=1)
Element: Hardware	• Unique experience, MacBook (*n*=1) • Tech must work (*n*=3) • Speed increase (*n*=2) • Multiple projectors/tvs (*n*=1) • No Copying (*n*=1)
Element: Uses	• Warm-up activities (*n*=1) • Digital textbooks (*n*=1) • Just a tool (*n*=1) • Enhance student learning (projects) (*n*=1) • Research (*n*=1) • Instant grading (*n*=1) • Limitless access (*n*=1) • Collaboration (*n*=2)

- "Now that I'm more comfortable with it, now that I've experienced actually instructional technology, my gut feeling is it's necessary for our students. I think if we if we don't expose them to that in some way then we're putting them at a disadvantage in the future."
- "I think it has a huge influence on my projects … to provide my students with the most applicable kind of authentic style projects, is to find ways of incorporating unique uses and kind of real world uses of the technology to the content that we're studying in class, so they can really apply it to something that's relevant.'
- "I think that what we're seeing here at Minarets we are attracting a lot of students who have needs that are not being met in a traditional high school. And by that, I mean students who have dyslexia are finding their way here because of the technology. Students who have ADHD, this maintains their focus a lot better. So, we're attracting that."
- "Well, I mean it opens up all kinds of doors, because if they have laptops they have access to all kinds of software and other kinds of technology. Really the sky's the limit as far as what you can and can't do with them."
- "Just having the one-to-one technology in the classroom is outstanding … technology is the present and the future, obviously. Technology is going to just keep playing a larger role, and we need students who are prepared and comfortable and then ready to that."

(continued)

- "I think instructional technology makes them [teachers] even more powerful and … for learning to be relevant to them [students] it has to be part of their learning process."
- "I think for kids to be able to explore and for kids to be able to research and be creative, it's extremely powerful if not absolutely necessary for kids."
- "It [instructional technology] makes the teacher all the more effective and all the more powerful. I think the misconception now is a lot of schools are adopting technology, but it's just replacing instead of being innovative and transformative. A lot of times technology is just applied and its the same old stuff just digitally."
- "If it moves to a more constructivist instructional model, then technology is a fantastic tool. If it just replaces some other form of technology and the instructional model doesn't change, it's probably not going to have a big benefit for kids."
- "Kids need be constructing something, doing something, owning something and, if technology enhances that, then there's going to be greater learning and more a positive vibe on your campus and with kids growing up."
- "Well it's definitely the way of the future, and so you can kick and scream and prod and resist as much as you want, but it's here and it's here to stay. Not only is it more efficient, but it's what our youngsters are growing up with."
- "You still have to have an effective communicator, because otherwise all courses would be just online. So, I think while it doesn't take the place of the communication of a teacher, it really works to the personality and culture of our students come in."

Table J4

Student Use of Technology in the Classroom

Element: Organization	• Learning Management System (LMS) (*n*=1) • LMS for assignments (*n*=1) • Color coded stickies (*n*=1) • Use of rubrics (*n*=1)
Element: Data Access	• Teacher sites (*n*=1) • Research (*n*=1)
Element: Collaboration	• G-Suite (*n*=1) • Communication (*n*=1) • Collaboration (*n*=1)
Element: Time Management	• Warm-up activities (*n*=1) • Time savers (*n*=1)
Element: Creation	• Electronic journals/notes (*n*=1) • Google Apps (*n*=1)

(continued)

	• Projects (*n*=2) • Video (*n*=1) • Photos/photography (*n*=1) • Audio (*n*=1) • Mapping (*n*=1)
Element: Communication	• Presentations (*n*=1) • Blogs (*n*=1) • Presenting data (Infographics) (*n*=1) • Public speaking, social media, messaging (*n*=1)

- "One of my favorite things that my students do with technology is we use iBooks Author to do an electronic language journal throughout the year. So that's where they will write notes, and if I'm doing kind of more of a direct instruction or if we're doing a guided exercise or practice, that's where they'll write their interpretation, or something, or their responses to questions that we ask for communication based activities, so it kind of provides them with a running track throughout the year …I really like having it be electronic, because then they can add their own pictures to it from you know pictures they take on their phones. They can add you know pictures they find from online; they can make those connections a little bit more directly."
- "All of our credit recovery students that are in my interventional classes are on programs on the computer. For the kids who are improving their grades with the technology, they are instantly able to see what their grades are, what they're missing as far as assignments, what needs to be resubmitted because they get comments from teachers immediately. I also use the stickies that are on here and teach the students to, on their dashboard, have a sticking up for each one of their classes and what is their priority in each of those classes. What needs to get done, and they're color-coded. It's instant; instead of wading through everything they can narrow it down. And that seems to help a lot of students."
- "I have a lot of moments where many people would lecture, so any kind of historical context. Rather than lecturing, I kind of assign certain responsibilities to various groups of students, and so in small groups they'll do the research, put it in a presentation. They'll present and I'll weave in and out of their presentations and kind of insert my own data."
- "With technology, really you can just say, "I want you to know about this," and "look this up now" so you have a data, kind of do research, versus here's a text book and here's a packet, you know, so."
- "A lot of times I'll show them some of the basics. I'll give them that early demonstration and they'll learn to use the tools in ways that either I hadn't discovered myself, weren't able to teach them, and then they become the teacher not only back to me but other students. So and I really get excited about that. When kids start using technology and they learn something and then they teach other kids, I've got something going on there."

(continued)

- "Our sound lighting class is doing everything cutting-edge. We can remotely operate the sound system from the iPad so you can walk around … and do the entire sound from an iPad or computer… They can create their own light shows on the computer based, on the hardware they've input, and they can do lighting shows. They're doing separate designs for all the dances at school. So, we try to stay cutting-edge, not only to use technology, but to be relevant in the industry."
- "All of them blog for the most part, so they have accounts on blogger, and I give them prompts based on either reflections or things that we're learning about or current events, and they publish that."
- "In my classroom, they're using it constantly and there's times, like teaching geography is kind of hard, because there's sometimes just that benefit of doing a map on paper that there's no tool right now that's super easy about like shading stuff in or I don't know just creating a map that, I still there's still a time and a place for paper, but for the most part in history it's pretty much tech based at this point."

Table J5

District Influence on the Use of Technology

Element: Fiscal	• Equipment (*n*=2) • Equipment replacement (*n*=2) • IT Support (*n*=1) • Quality of tech (*n*=1) • Equipment, classroom (*n*=1)
Element: Training	• Training access (*n*=3) • Tech progression (K-12) (*n*=1) • Project Based Learning (PBL) progression (*n*=1)
Element: Support	• Full support (*n*=1) • Program and G-Suite access (*n*=2) • 1-to-1 from day 1 (*n*=2) • 24/7 access (*n*=1) • Collaboration opportunities (*n*=1)
• "Funding so that we have access to amazing tools for our students to use, and then providing us with training as far as how we can make the most out of them in our classes." • "I would say that it's been critical if I'm talking from a funding standpoint. I know that district-wide say that the elementary schools are also getting exposure to that which means that the students who come from the elementary schools come here already understanding how to use some of those tools, and being really fluent in technology and in their use of it. So, I think to an extent that it's definitely critical that the district is preparing even the younger students to move into kind of this new mode of education."	

(continued)

- "They've done nothing but support the direction in which Minarets as a staff and administration wants to go."
- "I will say that I feel the district has made a big push to increase the quality. They just purchased a whole bunch of brand new MacBook Airs."
- "They provide us if we need to go to trainings or any in service; they provide us with the means to do that."
- "Well it's really been instrumental from the beginning. One advantage we had was we started off as a one-to-one laptop program. So when schools come to visit and they say, "how did you do it; how did you on board the teachers" and everything, it's like well, the advantage that kind of already existed. So, the district really was committed to technology from the beginning."
- "We've been through two different superintendents in the last four to five years and now we're getting that support from the board. We've retrofitted so there's a continued community support for 1-to-1 deployment that you just frankly get spoiled with. You don't have that sometimes in other districts, and because it is a financial obligation that's outgoing… So, I think they're doing a lot of support at the board level and the superintendent level and of course certainly at the school we try to support that."
- "The district bought what Minarets was selling… and the district made the commitment. They saw, they believed in the people who originally said, "hey this is the way we need to go." They footed the bill for it, that included outfitting every kid with the original MacBooks."
- "So, the district facilitated the overhead, but also is encouraging at the lower levels [elementary schools] to prepare students."
- "With buying the new MacBook Airs that just further demonstrates that they want us to be on the cutting edge and they want us to be using technology, because they're investing in it… seeing the district invest money, and grow programs, and constantly innovating, that says a lot. It affects the tech here, because then we feel encouraged to innovate and do all of those things."

Table J6

School Influence on the Use of Technology

Element: Hardware/Software	• Programs adopted (*n*=2) • Time restrictions (*n*=1) • Admin Support (*n*=3) • Teacher support/training (*n*=9) • Learning from other teachers (*n*=1) • Supportive staff (*n*=1)
Element: Project based	• PBL (n=4) • PBL through Tech (*n*=1) ○ Tech access (*n*=5)

(continued)

	○ Tech focus and Integration (*n*=2) • Amazing projects (*n*=1) • Celebration of project accomplishments (*n*=1)
Element: Leadership	• School is district leader (*n*=1) • Hiring the right teachers (*n*=1) • Teacher experts (*n*=2) • Culture (*n*=2) ○ Student success (*n*=2) ○ "Go Big! Go Pro! Go Now!" (*n*=3)

- "In many wonderful ways, I think we definitely get a lot of exposure to different ways that we can incorporate technology be it through professional development or through connecting with other teachers you know. If we do a staff meeting we talked about different project ideas and we brainstorm like different real-world applications that we can create different, different styles of projects that we can do."
- "The school really encourages us to be creative with our use of technology …and I think that encourages us as teachers to keep pushing for new ideas and for new uses of technology."
- "So, I was used to using books and such, and here we have a lot more opportunity. So, I had to kind of train myself to remember that I had a much bigger pool to work with."
- "The big push for everything to be large projects and be very public with this, we definitely really try to up our ante when it comes to showcasing our projects for the public... It is more than our projects aren't just a picture on the wall…were able to put this on the internet or put this for the public to see something physical."
- "Interest in training and the focus is always on how we use technology to enhance our classrooms and get through to the students. It always comes back to how are we going to maximize the laptops and the technology to teach those standards, and to really help the students grasp that."
- "I think culturally just the acceptance of trying new things out, we don't - we're not in a restrictive environment where a lot of things are tied up and restricted, they are able to try out new programs and I think that kind of freedom has helped us progress faster."
- "We're a project-based learning school but to us that's always been directly tied with the technology, because we're not bringing in poster boards and foil, we're doing our projects through the technology so that's always tied in. So, it's always been a critical part of the culture here and that's been huge for our development."
- "We kind of steer the ship in some ways, but the big thing is that that is hiring teachers, right, that are into technology, want to try to use it in their classroom, want to try to develop lessons and projects, because we're a project-based learning school, around technology since kids have it."

(continued)

- "The motto of the schools is "go big, go pro, go now" and that's a cultural thing, but it involves the technology. There are students who have published things on iBooks and are published authors right now. There are students who have won movie awards being teenagers in high school, and the school encourages the use of the technology because it's in every class. It's how they turn in assignments. It's how they how they can gather the feedback for those assignments. It's how they keep track of scheduling."
- "The administration here has had to buy in to what I want to do. It's understanding that these tools we have can be used in different manners, and it's not just their vision, they're supporting that down to the teacher level as well."
- "I believe in every classroom it's used in every class. We also have like a new campaign going right now for respect the tech, of taking care of it, use it in a professional and productive way."

Table J7

Difference from Other Schools

Element: Leadership	• School leadership (*n*=1)
Element: Atmosphere	• School size/teacher Selection (*n*=2) • Constant work in progress (PBL, 1-to-1) (*n*=2) • No preset criteria for success (*n*=2) • Constant refining (accepted by stakeholders) (*n*=2) • Changing educational landscape (*n*=1) • New MacBook Excitement (*n*=6) ○ Inspires use and creation (*n*=4)
Element: Culture	• School culture (*n*=12)
Element: Project Based Learning (PBL)	• Students doing real world work that matters (*n*=9) • Curriculum experience (*n*=4)
Element: Technology	• Instant access to internet (*n*=7)
Element: Relationships	• Teacher-student relationships (*n*=2) • Student surveys (*n*=1)
• "I think one of the most unique things is the, I think for me the biggest thing is probably the project-based learning… I think that our teachers are really invested in creating a unique experience for our students and that is at the heart of what sets us apart is our desire as a school staff to create something different for our students."	

(continued)

- “I think first of all it's 1-to-1 obviously, and but also the fact that the school is project-based, so these students are doing more real-world applications than the traditional paper pencil read out of the textbook answer the questions.”
- “The other thing is that there are things offered here that there aren't at a lot of traditional high schools. With media, with the way that students are encouraged to find their path, their career path, so early and really tap into where these kids thrive and where they're passionate and assist them in, you know, going on that path. Whether it's presenting media over at Apple or Facebook, you know we've had kids doing that, we've had kids you know winning national speaking contests, we've had our career technical education stuff, our CTE stuff. So, I think that those are the main ways that Minarets is different.”
- “I think that definitely falls into our culture. I think that we’re less concerned with having this big uniform thing that you would find in a lot of other school districts. Where everybody kind of has to be doing the same thing and pointed the same way. We kind of allow students to be themselves and pursue what they want to pursue, and I feel like there's a lot more student choice if that makes sense. We try to find that engagement that other schools don't really care about.”
- It has amazing teachers, dedicated teachers. It has an amazing community, which, you know, very involved parents. Very supportive, very enthusiastic parents, and they believe in what we have here, And an amazing administration. Without those things, you can't be successful especially in AG… These teachers here they're so dedicated and I think it shows for sure.”
- “The biggest thing is the culture here, and that students feel like they have the freedom to explore things they are interested in and their skills, and really kind of develop that over time. And there's a lot more continuity as far as if a kid is really into filmmaking and that's his or her passion, they can use that in history or English or science or PE.”
- “Asking students what they're interested in and asking students how it's going. Surveying them is a huge part of it, and then the relationships between teachers and students is huge. They have a lot of access to the teachers and kind of that flipped model from sage-on-stage to facilitator has been here since day one, and it’s really created a culture of collaboration with the kids.”
- “I would say that the focus here is not just on college and career, but on developing kids holistically as a whole person, and yeah pushing them academically, but also making them understand that we're trying to develop them into a successful person, and not just this is going to help you in college or this will help you get a job.”
- Well I think more than any school that I've been at, is it's definitely leaning away from behaviorist type, to more of a constructivist base, that the kids are going to create meaning, create knowledge and create importance by doing projects and doing meaningful things in the community. So that's a shift in mindset. It's difficult to do, but, and it's a constant struggle, but we're a project-based learning school. The technology is the enhancement, it's the icing on the cake. It's the thing that helps drive that forward if you will, but it’s really the underlying rock in getting kids to create meaningful things.” (continued)

- "That's a big shift in education and I would say there are very few public schools in California and in the nation attempting that and committed to that, and committed to it. Not going to walk away from it or shy away from it so. There are more coming on board every day, but I think Minarets is significantly different because it's a project-based school and it wants kids to present out in the community."
- "I think from day one it was we're going to be different, not just for sake of being different, but we're going to be different allowing the opportunities to see things "yeah, I want to try that", and being able to have the go ahead, absolutely take them all over the globe."
- "There's so much about Minarets. I mean the students are so different. I mean so many of them are just choosing to be here, because it is mostly charter. The teachers for the most part all on the cutting edge. They want to use technology, they want to improve it. The district wants to be on the cutting edge, the school wants to be there and so there's just that push of professionalism that we want to be out there in the world and we want to be doing the newest and the coolest stuff and the support from my administrators. For me it's a dream school, but I love technology and I think the tech plays into it too, that just makes the school even more special."

Table J8

Duplicating the Culture into Existing or New Schools

Element: Curriculum Requirements	• Full technology access (*n*=2) • Project-Based Learning (*n*=1) • Rigor (*n*=1) • Relevance (*n*=1)
Element: District/Admin Requirements	• Commitment from School Board (*n*=1) • Commitment from school staff (*n*=1) • Commitment from school community (*n*=3) • Can't force the culture shift (*n*=1) • Commitment from leadership (*n*=5) • Mindset (success does not come from tests) (*n*=1) • Just supportive, and it makes a difference(*n*=1) • No need to force tech use (*n*=1) • In established school, you are fighting many different cultures (*n*=1)
Element: Teacher Requirements	• Special teachers (*n*=6) • Commitment to relationships (*n*=1) • Commitment to creating student experiences (*n*=1)

(continued)

Element: School Requirements	• Community Culture (*n*=1) • Advantage of being a small size school (*n*=2) • New school would be easier (*n*=1) • All-In (*n*=1) • School culture (*n*=3)

- "I definitely think so I think the access to technology is a huge part of that and that's probably one of the biggest challenges is making that available to as many students as possible."
- "I think those three things [rigor, relevance, relationships] are like really great keywords that all schools can take with them and/or new schools that are being created is to really incorporate those three things in a way that gives our students a quality experience that really feeds them with knowledge they can apply after they leave school."
- "Absolutely, absolutely, if the school board, staff and community is behind it. You can't force it, it really has to be something that comes from within and sets the stage for it and then get students on board. But if you don't have community, board, staff support it will be a struggle."
- "Oh definitely, and on that same note I believe it can always be improved upon… It definitely comes in the leadership."
- "You have to get teachers who care about student interest. You have to get teachers who are willing to constantly reinvent the wheel and rework their own things (in my case I've rewritten my curriculum every summer). You have to have people who are willing to use their free time to do that or it will not work. Because you need to constantly be making things new, updating things, tweaking things, otherwise it gets stale and the students will stop caring because you've stopped caring. So, I think it comes from the teachers, the way they frame stuff in the way they constantly reinvent stuff."
- "They [administration] need to be willing to take risks and do things that don't necessarily add up to test scores, because test scores do come from critical thinking and they'll eventually get there, but you have to take some risks first, it shouldn't just be test prep all the time."
- "Well I think it can, because it's not like, you know, there's some magical spell on this property kind of thing. I think you need the components. You need good administration. You need a good community that is involved and cares."
- "Absolutely I think this can be duplicated other places, but I think it has to meet the needs of the community, in the demographics of the community."
- "I come from a large school district. I come from large high schools. You're going to have to break them down into structural teams... I think there's an opportunity to do that, right, if they have their vision and they know what they want to do I think it can be duplicated large scale."
- "School board, superintendent, principals have to be the leaders there and then they can get their teachers, because they know there's the teachers [who] will feel comfortable with that because there's commitment from the people that are in charge of running the system." (continued)

- "You have to have the right team, you've got to have teachers that are motivated and want to learn and want to keep up with the current teaching strategies and different methodologies for classrooms. You are going to have to have good leadership; if you have all that I think you can make it work anywhere."
- "A newer school, it would be easier to implement this, to duplicate. The problem with doing this with an existing site is, I believe in my experience at that management level, is most places would want to do it on a pilot program… and I don't think it works because it is truly the culture of Minarets, not only the administrators that have the vision, not only current administrators, not only our staff, it's our students. It's our students' culture of being here! There has to be a total commitment, so, but at the same time I don't think you can pilot program that. I think there has to be enough belief that this is a way we're going to go, because this was brand new and it was hard enough to get everybody on board and do it."
- "I feel like some parts of it can be. I feel like it could be, especially with project-based learning, it would just need teachers to accept change and be okay with it, and not be afraid to experiment and change. I don't think it could be duplicated completely, but I feel like parts of it like the tech and the project-based could be."